HYGROMEDRY.

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H. Emerson Wetherill M.D.,
3734 Walnut St., Phila.

HE, 5

HENRY EMERSON WETHERILL.

Hygromedry, 4th, Edition.

Revised, Enlarged; With Many New Plates.

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PHILADELPHIA.

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Dedicated to those
who have encouraged me in
this research.

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HYGROMEDRY.

By

HENRY EMERSON WETHERILL,
M. D., Lt., Jr. Grade., Surg., &
A. I. R. P., N. F. Pa.

Sometime Fellow Amer. Geog. Soc.,
Member Acad. Nat. Sc., Phila., and
Amer. Ass'n. Adv. Sc. Late 1st. Lt.
& A. S., U. S. Army. Mem. Phila.
Co. Med., Pathological, and Neurolog. Soc's. Penna. Med.
Soc. Hon. Life Mem. Pa.
Botanical Soc. Amer.
Med. Ass'n.—etc.

Author of Medical Color Tests, Greenland's Flora, Prize Thesis on Symphyseotomy and New Diagnostic Instruments.

Longstreth Medalist, Franklin Institute,
1905.

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(FRONTISPIECE.)

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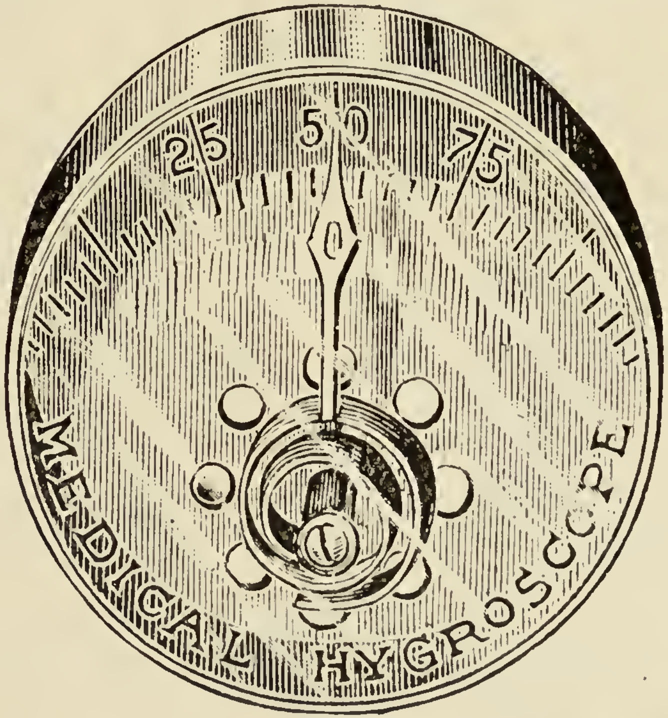
Advertisements, with many illustrations. These include new diagnostic instruments, and charts.

PLATE I

What the Clinical Thermometer is to Temperature, the Hygromed is to Moisture.



The HYGROMED.

(See Page 7 Col. 2)

(See Page 12 Col. 1.)

PREFACE.

This outline of Medical Hygroscopy is written to call attention to the practical usefulness of the subject in everyday clinical work. The more intricate mathematical and theoretical considerations have only been referred to, but what they do in a complicated way has been done by methods here explained, and carried out in an easy and simple manner, so that there should be no difficulty in carrying forward practical, important, and correct observations.

Enough work has been done, and sufficient data have been supplied, to show that this subject has an important medical bearing, particularly now that there are practical methods of observation, and plotting.

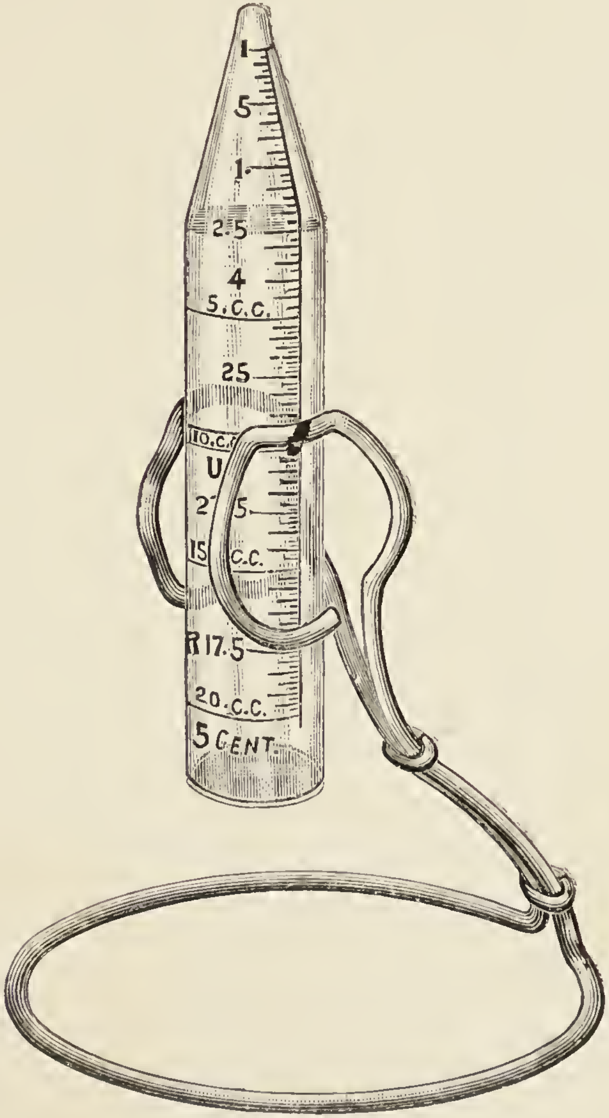
I wish to acknowledge the many kindnesses of my friends in helping to gather data, reading proof, etc.

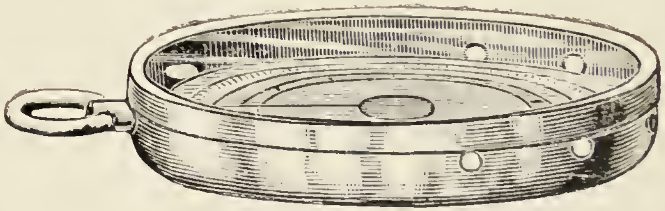
Also the use of the Pepper Clinical Laboratory, Univ. of Penna., Phoebe Hearst foundation, and of other institutions in some aid of the work, and the grant from the American Medical Association, not yet received.

Recognizing the imperfections likely to occur in any work of human undertaking, I solicit any corrections, or criticisms, that this subject may be of more and more use to humanity,—depending upon the amount of work done upon it—and if I stimulate further research for a better diagnosis of disease, I will feel my labors have not been in vain.

HENRY EMERSON WETHERILL.

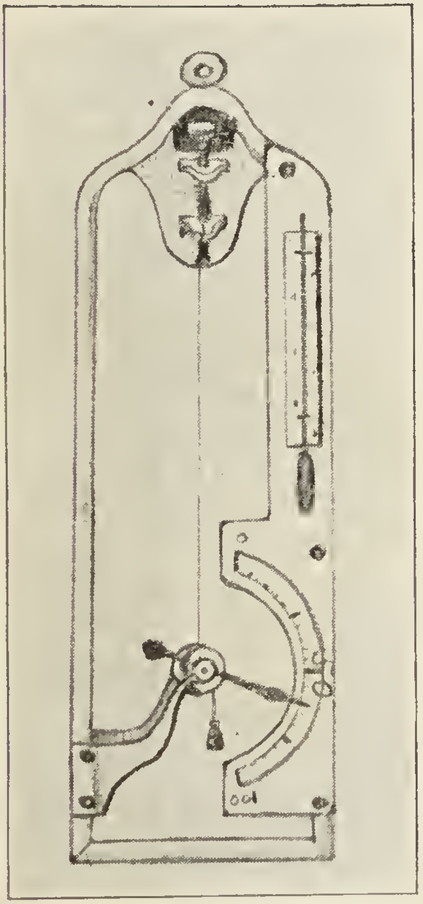
3734 Walnut St., Philadelphia, Pa., February 12th., 1905.



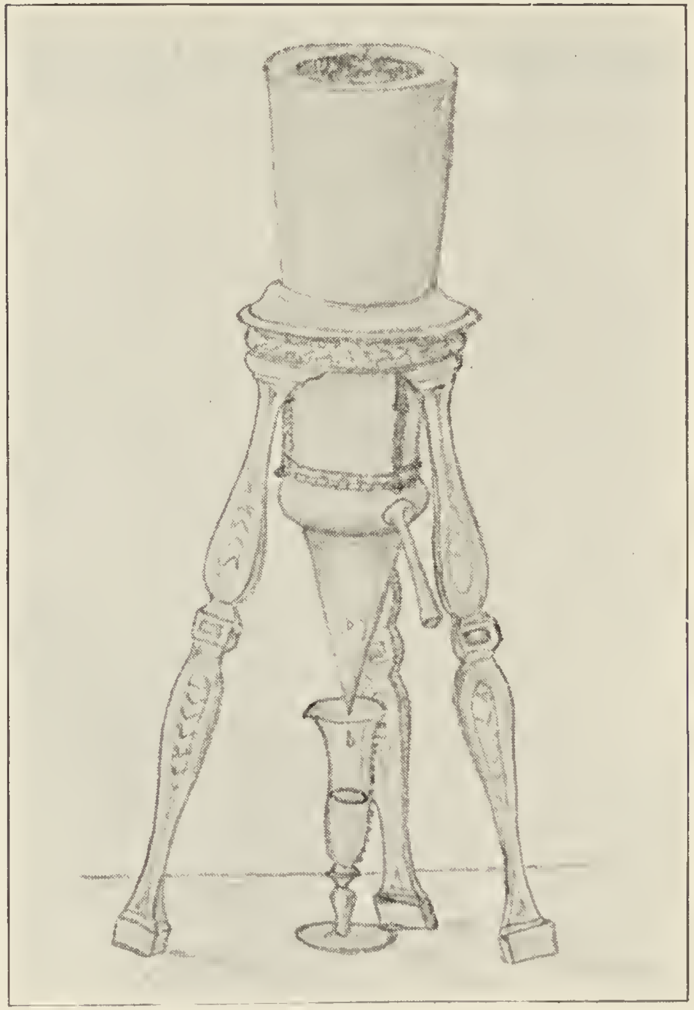


Cobalt
Hygroscope.

Some Relative Humidity Instruments.



A Form of Saussure's Hair Hygroscope.



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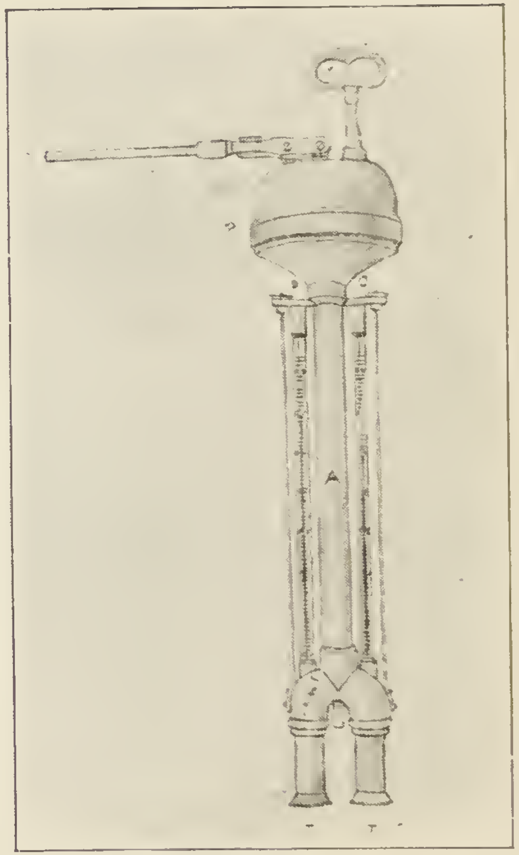


Assmann's Psychrometer.

Chronological Consideration.

CLINICAL HYGROSCOPY.

An outline of the subject, with some practical and useful results, as well as suggestions for future work.

Definition.

By Clinical or Medical, Hygroscopy, or Hygrometry we mean the measurement with the Medical Hygroscope, otherwise called the Hygromed,—or other apparatus, of the moisture of the body, and of its surrounding environment.

Hygroscope is pronounced (hi-gro-skop).

Its Grecian derivation is from two words, ὑγρός , wet, moist—and σκοπεῖν, to view.

The words Hygroscope and Hygrometer are often used interchangeably, but more particularly a hygroscope measures the moisture by using an organic material, whereas hygrometers generally depend upon the use of the wet, and dry-bulb thermometers.*

Its principles are based upon the meteorological laws connected with Relative Humidity Units, and in its application by the physician it is the adaptation of Relative Humidity Instruments for medical work, in a similar manner, as has another meteorological instrument, namely, the thermometer, been applied for his purposes, as exemplified in the clinical thermometer.

As Sweat is generally 98.88 percent. water, its measurement can be made on that basis, allowance being made for the solids.

(Here put in the picture of a type of meteorological spiral hygroscope.) Plate 2, page 10, No. 1. Ref. ps. 5 and 12.

This is practically a new field of medicine, for very little work has been done

---

* Moisture Instruments. Hygroscopes, a material alters in size with the humidity. Hygrometers, condensing, are dew point instruments. Evaporating, like wet and dry, bulb thermometers. Chemical, weigh the

Preliminary Matters.

as yet. Its practical importance I believe all will concede if they take pains to peruse this outline of some results in clinical hygroscopy. Ref. page 18, col. 2. Ref. page 44, col. 2.

[1] There is practically no literature upon the subject, though I have looked carefully for it. I have published several short articles, but they have been too brief to thoroughly instruct upon the subject. I have seen hardly any other articles, except an advertisement of Dr. Wurster's Clinical Hygrometer, to which I will refer later.

Page 10, col. 2.

Plate 2, No. 2.

The Medical Hygroscope of my design is made to measure the perspiration, and I can now say it does it satisfactorily.

These references are given as they will prove of some value to those who wish to read up the subject.

In Dr. Draper's book on Medical Physics, Lea Bro. & Co., 1885, page 589. In this he refers to some moisture and metabolism tests, made about 1860.

In the centre of the page he makes a special appeal for such an instrument as the Hygromed now represents. Ref. page 23, col. 2.

His body balance is evidently too bulky for the use of all physicians, besides the expense is great, the whole body has to be carefully weighed, and the apparatus is not portable.

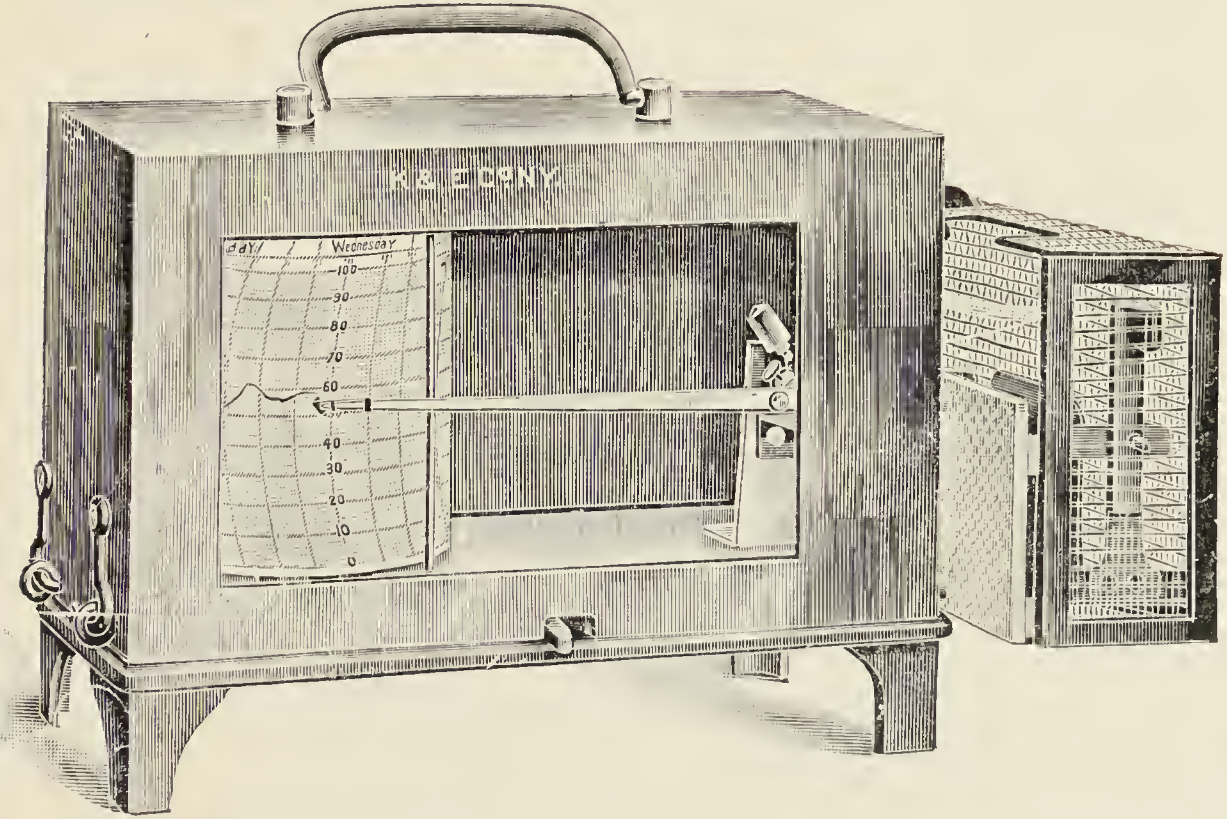
Another important reference is to that of Dr. Calliburcè's Complete Specification, Oct. 1, 1884, English patent office. Plate 2, page 11.

This reference is quite complete, and suggests much of the work I have carried out, and many of my ideas, and had I it at the start, instead of when this research was completed, it would have facilitated matters. It has failed in the main, principally on account of the impracticability and the cumbersomeness of the apparatus.

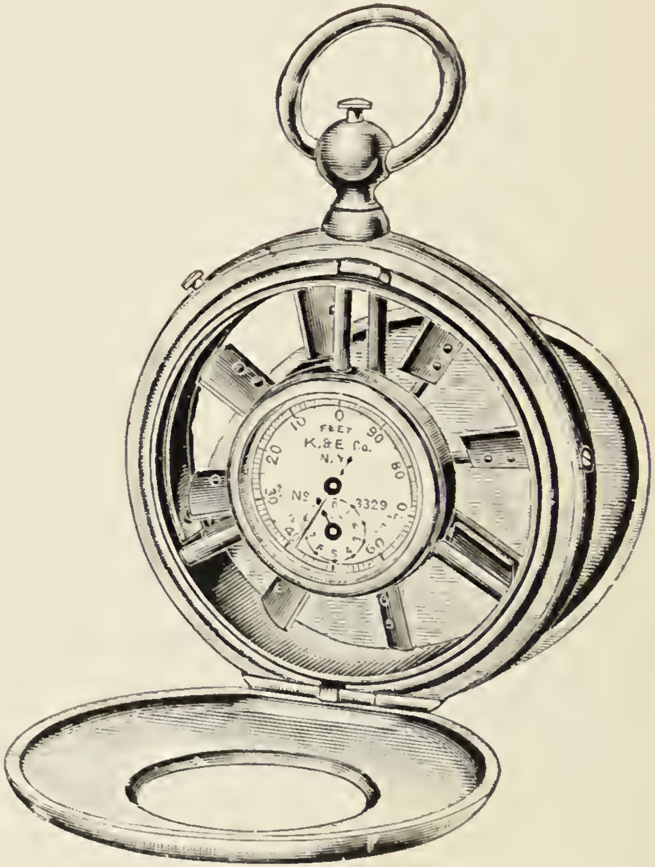
These difficulties I have overcome.

---

[1] In the latter part of the 18th. century Agnew collected sweat by inclosing a limb in rubber.

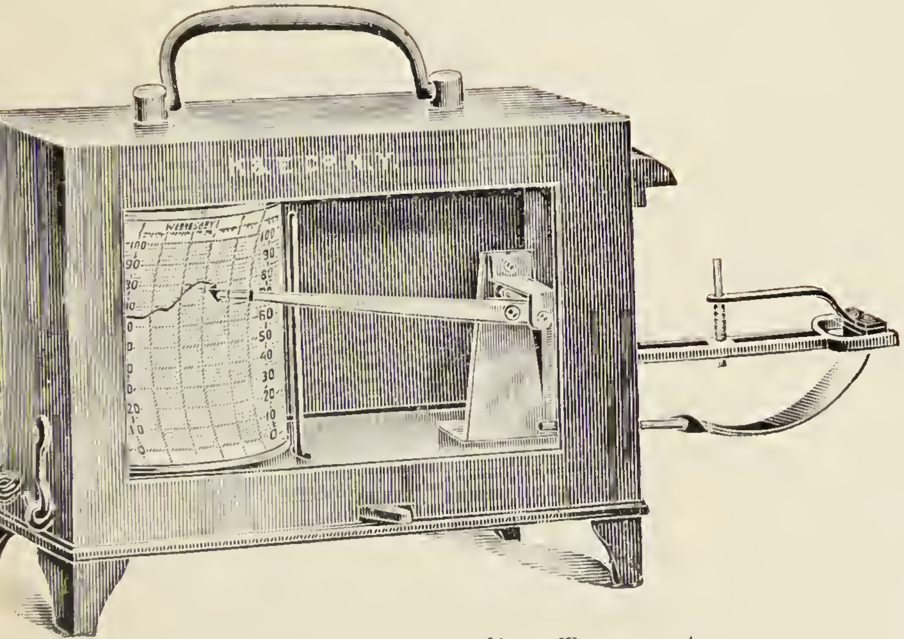


Hygrograph, for Plotting Humidities.

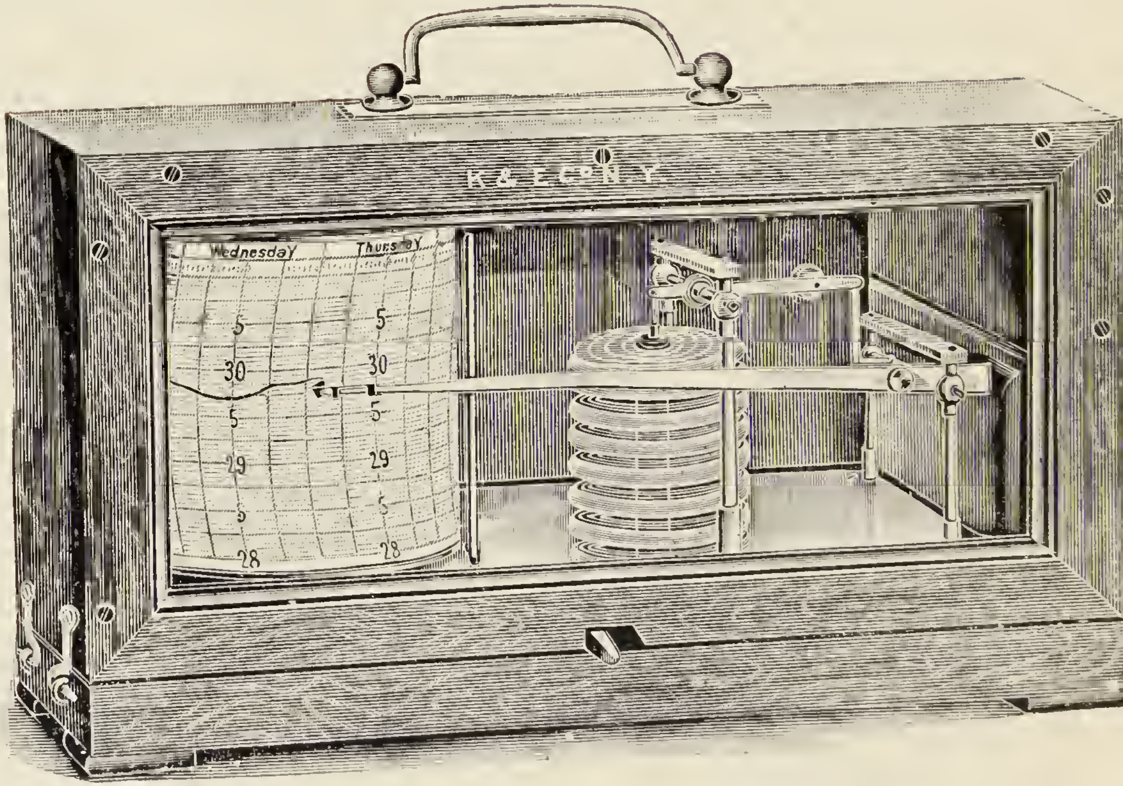


Anemometer, for Measuring the Circulation of Air.

A Correction Card accompanies these Instruments.



Thermograph, for Recording Temperatures.



Barograph, for Writing Down the Air Pressure.

References and Bibliography.

A preliminary instrument, and some tests from the Philadelphia Hospital, are described, with some other instruments, in the Medical and Surgical Reporter . Proceedings of the Phila. Co. Med. Soc., Dec. 11, 1897, Vol. 77, p. 741.

Medical Conference, Univ. of Penna. Dr. Jas. Tyson's clinic, 1897.

Proceedings Pepper Med. Soc., 1898.

Jour. Amer. Med. Ass'n, July 26, 1902, Vol. 39, p. 209.

Proc. West Phila. Med. Soc., Winter of 1903.

Dr. F. S. Pearce's book on Nervous Diseases, page 204.

This refers to observations on a case of paralysis. American Medical Association, annual meeting Atlantic City, N. J., 1904.

Penna. Med. Soc. Annual meeting at Pittsburg, 1904. Proceed., Nov., Vol 8, No. 2, p. 103.

This merely mentions the instrument, but also refers to the Torkrit, an instrument for determining the solids of the perspiration, by a two-way centrifugal method, a cord being used instead of gear-wheels. It also does the work of a hematokrit.

London Medical Press, Oct. 19, 1903. This recommends the Hygromed, and says—"This clever little instrument may not unlikely soon find its way into the clinical apparatus of the physician."

The Coca Leaf, Nov. 1904; gives a short résumé of my article in Amer. Medicine, and says,

"That the author has found after several thousand tests that this instrument is of important use in diagnosis, as it indeed seems to be."

American Medicine, VIII, 14, 1904. This is an abbreviation of the present article.

The Dr. Calliburce's referred to above is a Frenchman; his instruments were of two general forms of helicoid spiral hygroscopes, one covered, and one uncovered to the air. They are large and long. Plate 2, at page 11. (Not particularly medical.)

Medical Notes and Queries, Vol. 1, No. 1,

References, Dr. Klapp on "Insensible Perspiration"; J. Redman Cox's Med. Museum, vol. vi, 1809.

Proceed. Franklin Institute, Phila., May 11, 1905, The Hygromed and other of Dr. Wetherill's Diagnostic Instruments to have been presented before the Committee of Arts and Science, and the award made; see p. 71.

The Prior Art.

Proceed. Phila. Co. Med. Soc. Jan. 1905.

Dr. L. Napoleon Boston's book on Clinical Diagnosis, 2d. Ed'n. has a description of the Hygromed, and several other of my diagnostic instruments.

Dr. Wurtzer's German instrument was used at the Hygienic Institute in Berlin, under Dr. Koch, but the results I have not received. The instrument was an uncovered one, suspended from the neck, and working like Saussure's hair hygroscope.

The literature on perspiration is extensive, but upon its practical clinical measurement there nothing has appeared.

So far as I am now able to determine I first discovered that the perspiration would make the hygroscope go up,—back in 1892, while a student at the University of Pennsylvania, class of 1893.

Wurster's instrument was at that time unknown to me, and may have appeared later.

(Here the picture of Dr. Wurster's instrument may be inserted, with the following notations.) [Plate 2, page 10, No. 2.

The Clinical Hygrometer of Dr. Wurster. One-half size.

The indicator is pointing to 72 per-cent., Relative Humidity.]

DESCRIPTION.

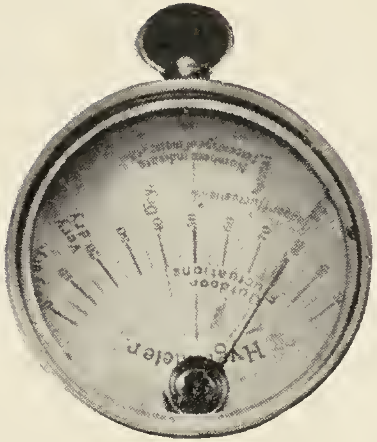
This instrument is of some use particularly where the atmospheric air is to be taken into account, but as we generally wish to as far as possible exclude outside humidity conditions, it is better to use the Hygromed, which can also be taken apart and be made to work like Wurster's clinical hygrometer.

In using the hygromed it is generally unimportant to measure the air moisture, but in careful tests it is best to take that curve also, this matter is of much

A good reference. Modern Meterology, by Frank Waldo.

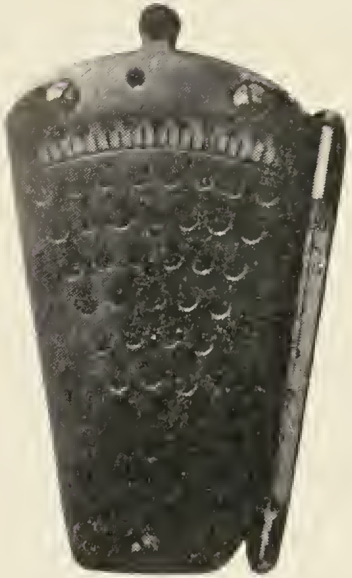
VARIOUS HYGROSCOPES.

1



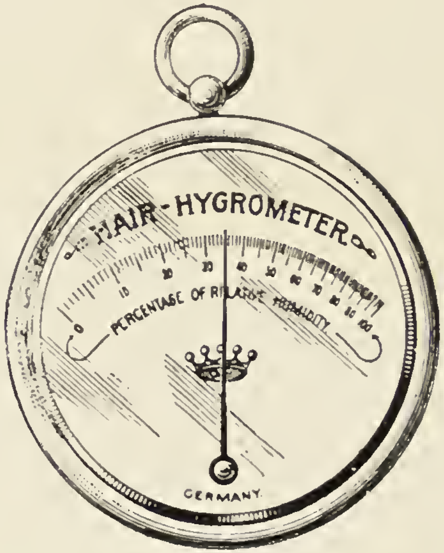
Meteorological Spiral Hygrometer. German.
Page 7. Col. 2.) (Page 12. Col. 1.)

2



Wurster's Clinical Hair Hygrometer.
Page 10, Col. 2.

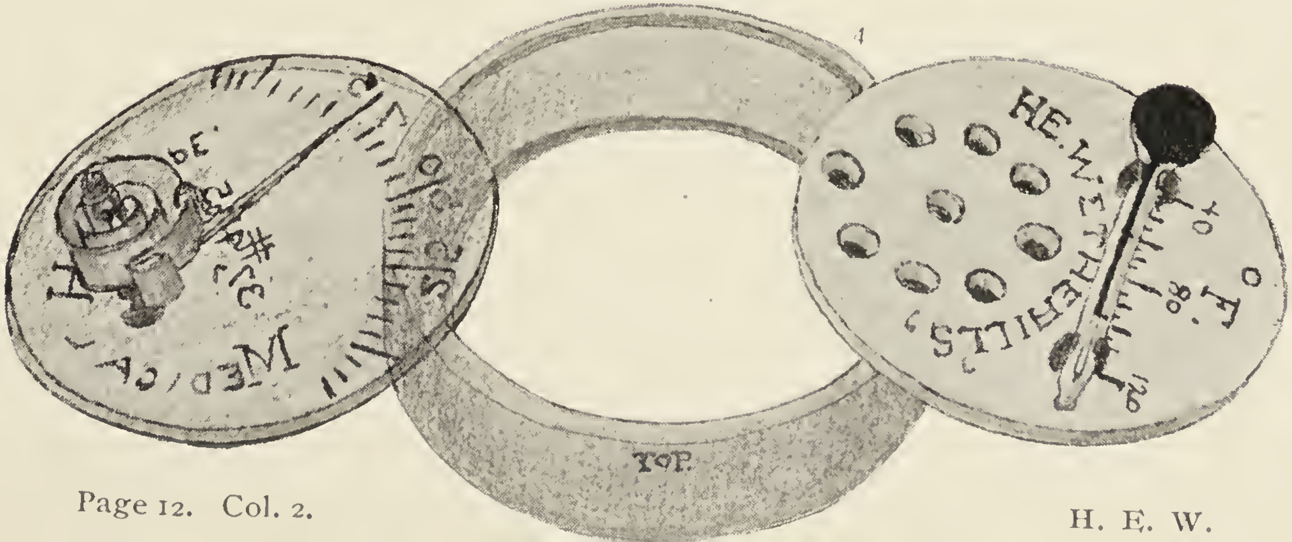
3



THE J. E. LIMEBURNER CO., PHILA.

A New Modification of
Lambrecht's Polymeter.
A Meteorological Instrument.

4



Page 12. Col. 2.

H. E. W.

Aluminum Rim, Celluloid Top, Aluminum Base Holding Surface Thermometer.

Showing the **Hygromed** in its Simplicity. Every part is accessible, using only the fingers.

Plate 2. Page 10.
Ref. Page 49 Col. 1.
Copyright 1905,

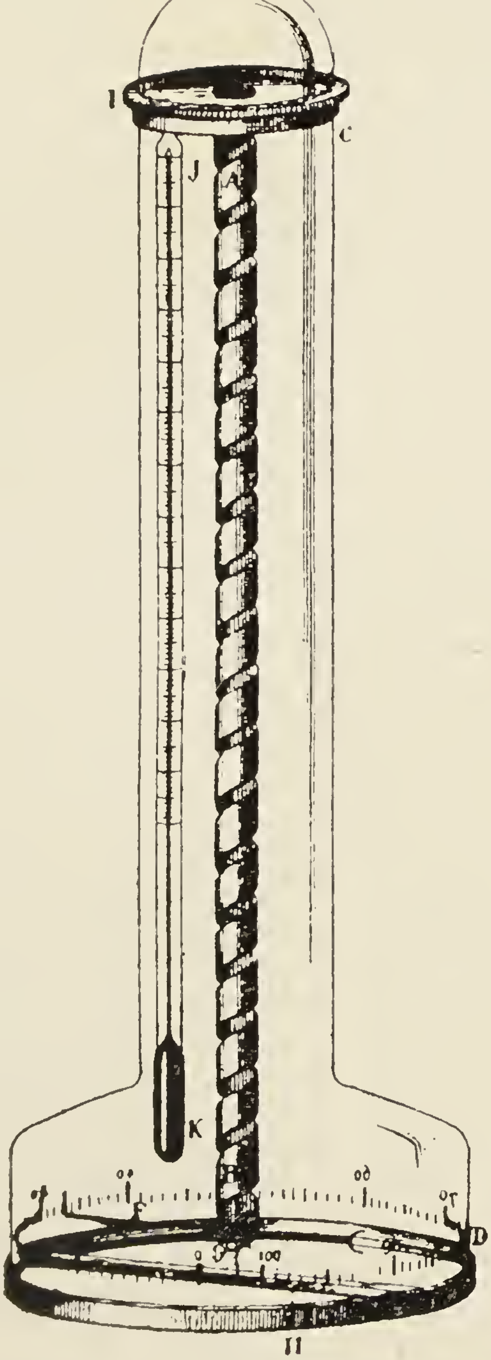
CALLIBURCE'S HYGROSCOPES.

(*Helical types.*)

These were used for testing Hygroscopic Substances, and for Clinical, and other uses.

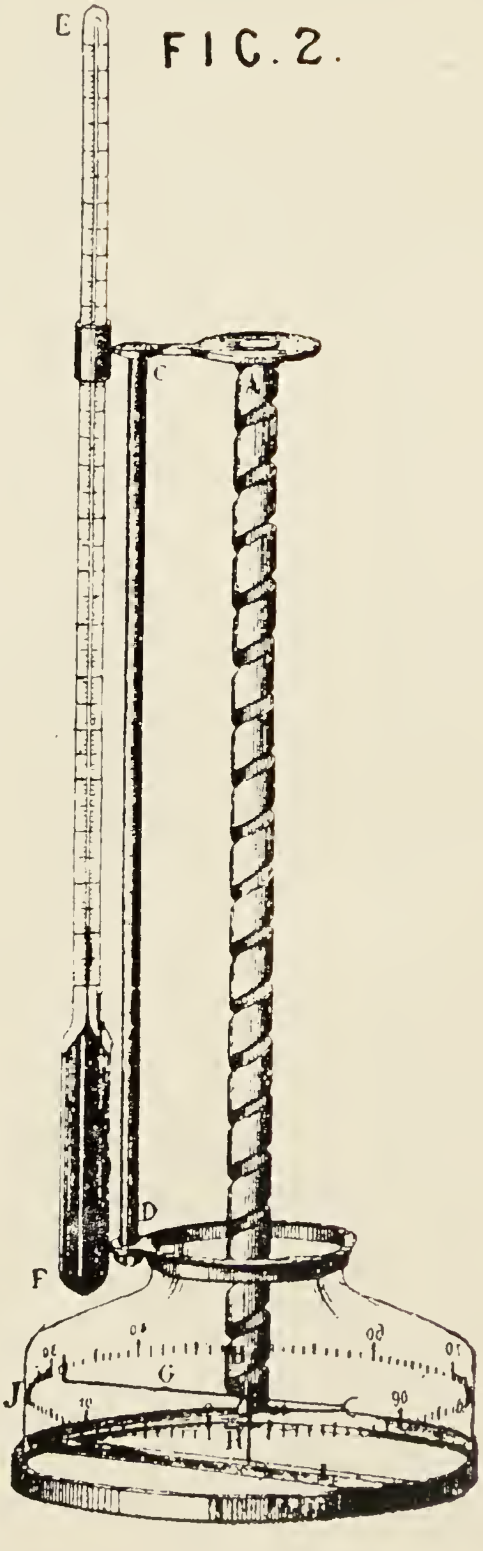
See Eng. Pat. 13,044, 1884.
(A considerable contribution to Hygromedry.)

FIG. 1.



Covered.

FIG. 2.



Uncovered.

Plate 3. See page 11. Col. 1.
Page 26, Col. 1,
Wetherill's Hygromedry, 4th Edition.
Copyright 1905. H. E. Wetherill.

more importance when Wurster's instrument is used.

Thus instrument is five times as expensive and complicated as mine.

(Here the picture of Calliburce's French instrument may be inserted, with the following description.) Plate 3, at page 11.

[The illustration shows a French form of the medical hygroscope, a covered, and an uncovered form, with thermometers that often accompany other instruments of this class, useful in further observing moisture changes with heat. This instrument is good to detect the hygroscopic factors of slightly hygroscopic materials.]

One of the first things one thinks of in this line is,—will the moisture and temperature of the air interfere with the results? With the uncovered instrument such as Wurster used it would appear to be so. There are times, however, when such a result would be desirable, as where we wish to know the moisture around the body, taking the outside meteorological conditions into account. This my instrument will also do when it is used with the parts separated.

With the perforated bottom, hairs are excluded. With the bottom out, the readings are quicker, but very little higher.

On the whole it is better to inclose the hygroscopic substance, and get a result practically independent of atmospheric conditions, as in the usual application of my most improved form, using it with the bottom in, as a standard method. Ref. page 49, col. 1.

The Construction of the Instruments.

Wurster's depends upon the change of

Illustrating the Hygromed.

the length of human hair, as with Saussure's hygrometer, and as in the usual form of the recording hygrometer. Mine is more closely allied to the egg-skin spiral form, as exemplified in the Mithoff hygrometer, made in Germany under D. P. R. 16,568. Plate 2, No. 1, at page 10.

(Here some pictures of the Hygroscopes may be inserted. Mechanical drawing of the Hygromed. Top view and section. Ref. pages 5 and 7.

A perspective view of the instrument with thermometer attached. A Medical Hygroscope that measures the perspiration as a diagnostic feature of various medical conditions. (Page 19.)

Perspective (colored ?) illustration of the Medical Hygroscope, Spiral pattern, number 37, 393. Full size. The num-

the slight corrections of this instrument are recorded. [Illustration, p. 57.]

Commercial picture, as marketed, the reading here being 50 percent. See page 57 and frontispiece, page 5.

This represents the instrument, full size as near pages 15 and 57.

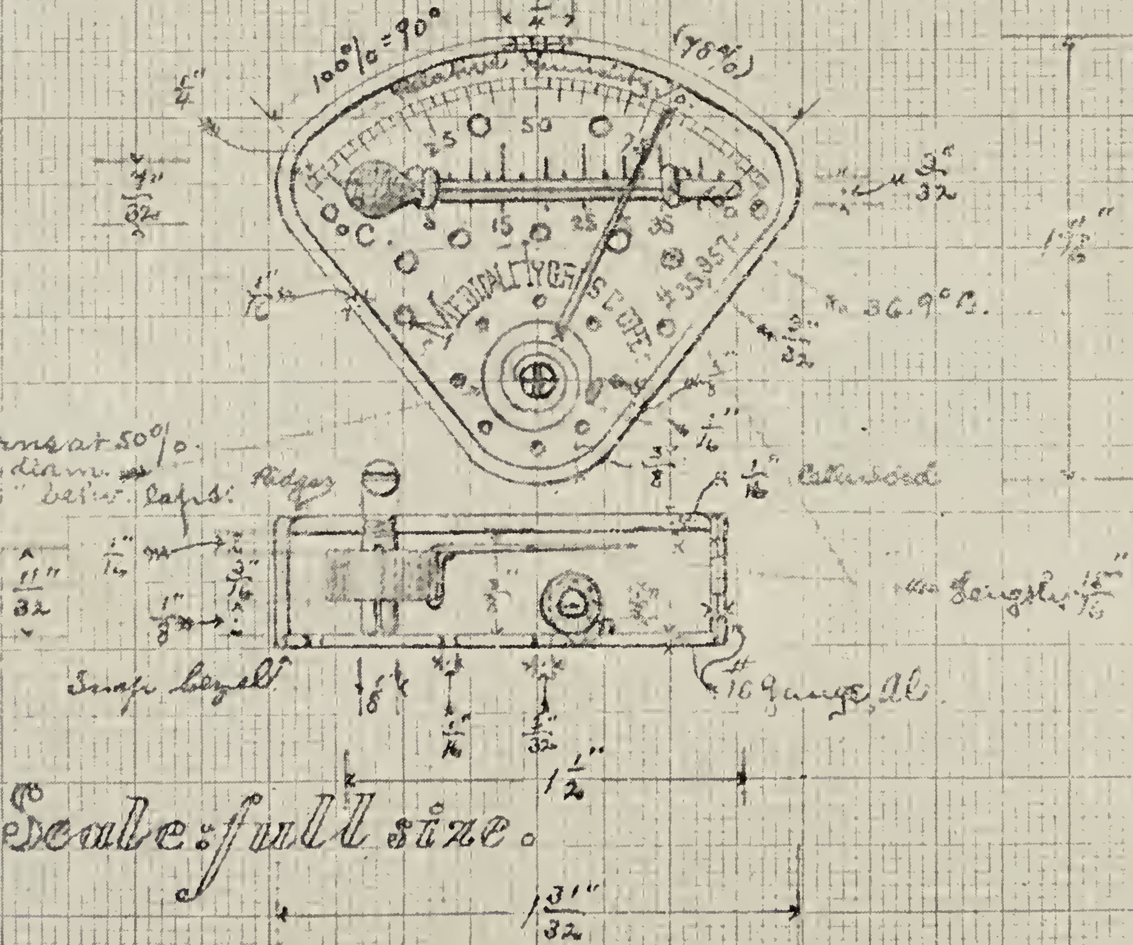
Colored (?) perspective drawing of a Medical Hygroscope Outfit. Refer to plate 2, No. 4, at page 10.

The thermometer, like the clinical thermometer, may have a slight correction, as plotted on lined paper in a curve. The Hygromed is similarly corrected, and its correction for temperature is practically inconsiderable. Refer to chart, page 64.

The curve of absorption of water by the chlorid of cobalt test papers is here indicated. A table of this method of measuring the perspiration is to follow.)

Dr. Wetherill's —

MEDICAL HYGROSCOPE.



turns at 50%.
ins diam.
.325" bet'n. caps:

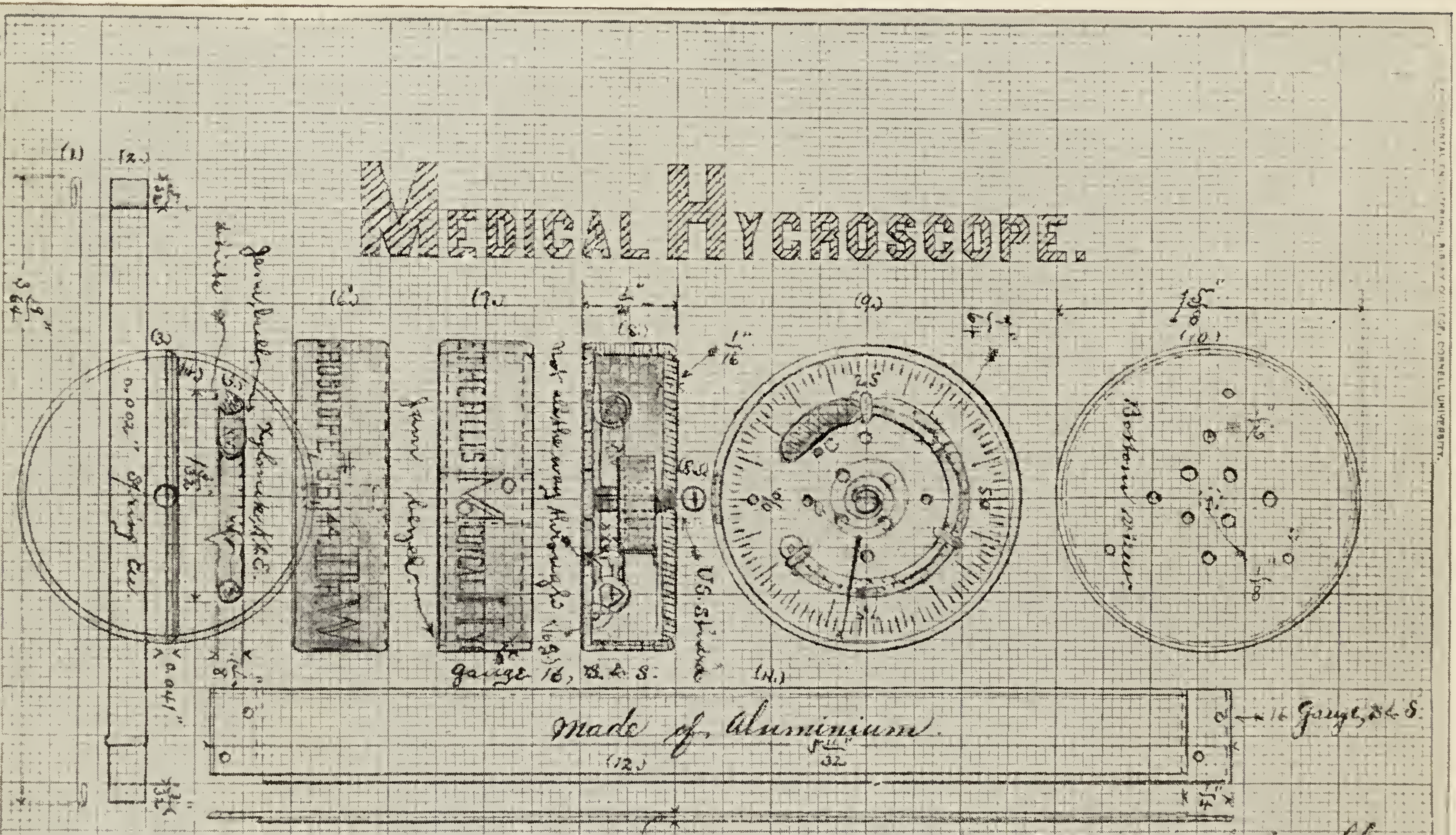
Scale: full size.

rts interchangeable, &
detachable.

(Price, $5.00)

Henry Emerson Wetherill
#3734 Walnut St. Phila
9. 21. 02.

RPENTER. ITHACA N. Y.


MEDICAL HYGROSCOPE.
(1)
(2.)
(3)
(4.)
(5.)
(6)
(7.)
(8.)
(9.)
(10.)
(11.)
(12.)
Jewel bulb
Hydroscopic white
0.002" Spring Col.
0.041"
Same length
Not all the way through
Gauge 16, B. & S.
U.S. Standard
25
50
%
Bottom view
Made of Aluminium
16 Gauge, B. & S.

The Instrument, How to Use it.

By referring to my finished form of the instrument in my pen and ink and other sketches, it will be seen that the base plate of the instrument can carry a thermometer, which may be used in connection with surface temperatures, and moistures. (Sketch may be inserted.)

It is not, however, absolutely necessary. (See picture at p. 12.)

The bottom is removable, as well as the graduated celluloid top, which carries the hygroscopic spiral.

There is not much more to be said except that the slotted head is used to adjust the spiral, which is of novel and accurate construction.

The instrument after being on the skin for five minutes registers the moisture near the body in percent., which is the relative humidity.

The moisture of the air near the body varies in different conditions, as tested for, it depends upon the cutaneous excretion, and upon the moisture of the air of the locality.

To avoid the errors sometimes caused by this latter, the instrument is made enclosed; and generally used so.

The very hygroscopic membrane, generally of egg-skin, specially prepared, or of gelatin, of albuminized paper; or other hygroscopic substance made reliable, and quick in action, is stretched on a springy copper spiral, and if the air is moist the spring relaxes, and the needle moves upwards—on the other hand should the skin of the patient, or the membrane of the spiral be dry, as in fevers, the needle goes in the opposite direction.

The instrument is sufficiently accurate to give valuable clinical data. The dial is made of celluloid of a firm, transparent nature, the case is of lacquered aluminum.

How to Use The Hygromed.

The lacquer prevents any alkaline secretions from acting on the metal. The metal quickly conducts heat, and together with the celluloid there is no practical interference with the moisture, as from surrounding temperatures, and there is no trouble with moisture condensations on the machine, nor absorptions of moisture, as when paper scales are used.

Small normal variations of persons are much exceeded by the pathological indications.

How to Use the Hygromed.

This is easily done, both by the patient, and by the physician, or attendant. The bottom of the instrument has some eight circular perforations in it, they are placed over the part to be tested, the moisture streaming out of the

the needle show the moisture.

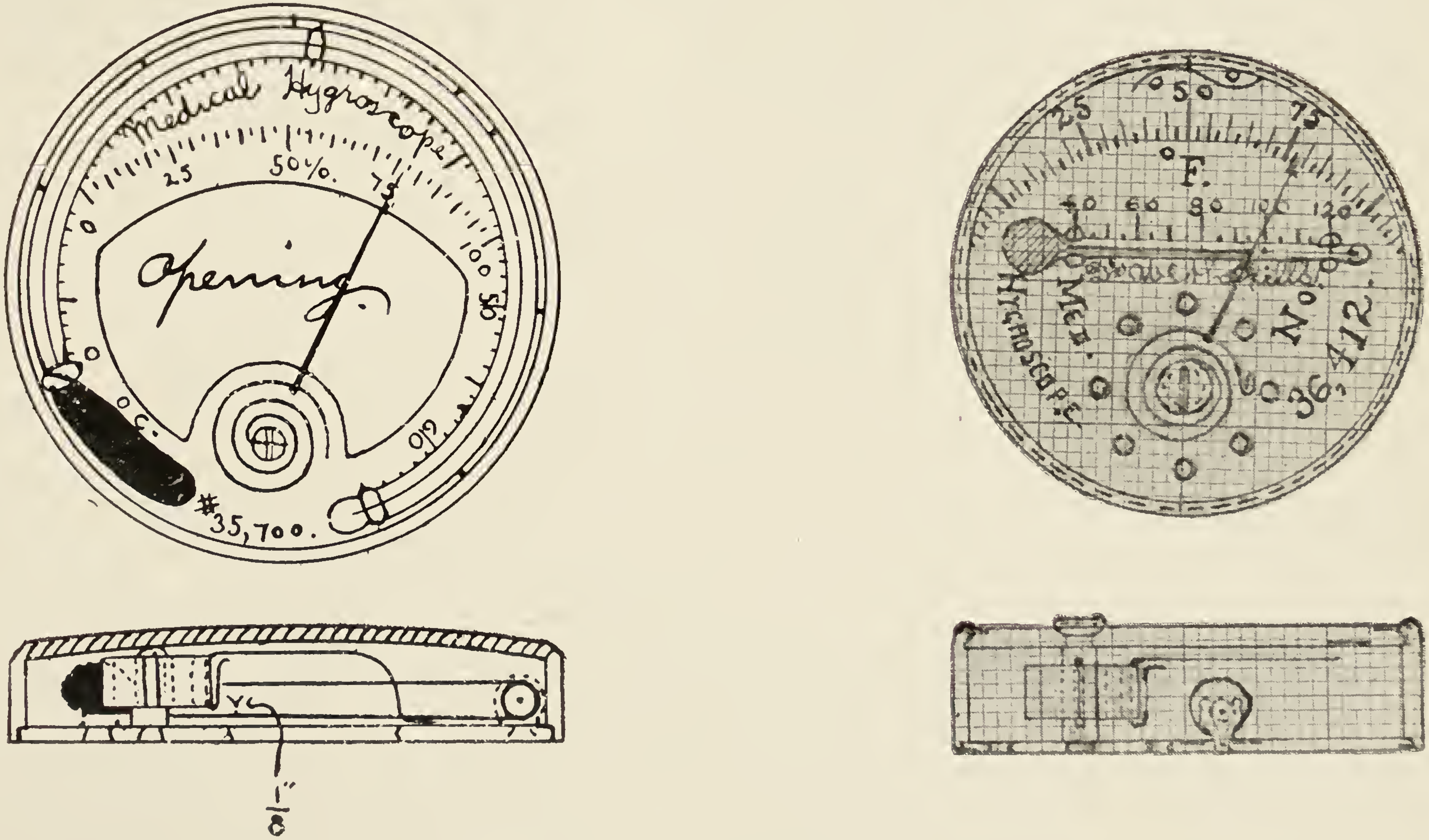
When placed on the skin the hand moves quickly at first, then more slowly, till the indication is reached in a few minutes.

It has been found most practicable not to have a self-registering moisture spiral, nor thermometer.

I have frequently taken the moisture and temperature without awakening the patient; and this can not always be done with the clinical thermometer.

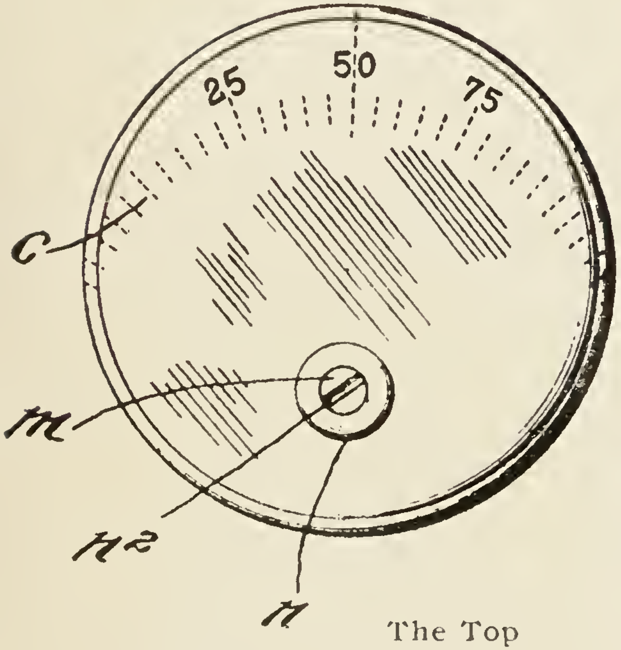
The instrument is held on the surface a standard time of five minutes. Like the clinical thermometer it does no harm to leave it there too long. Some instruments will register in a fraction of a minute. When the patient has had a bath, within five minutes previous to the test, the skin should be wiped with a towel, and this I always do for uni-

Some of the Experimental Hygromeds Tried.



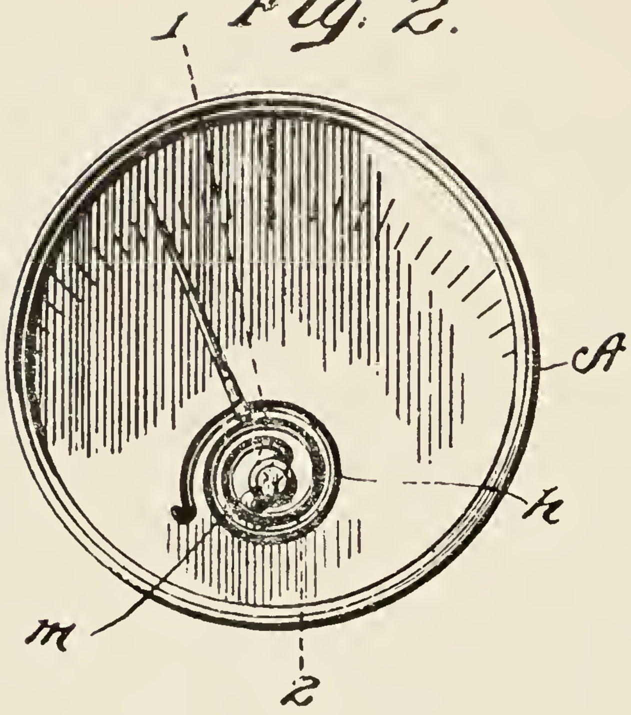
These pictures are actual size.

Fig. 1.



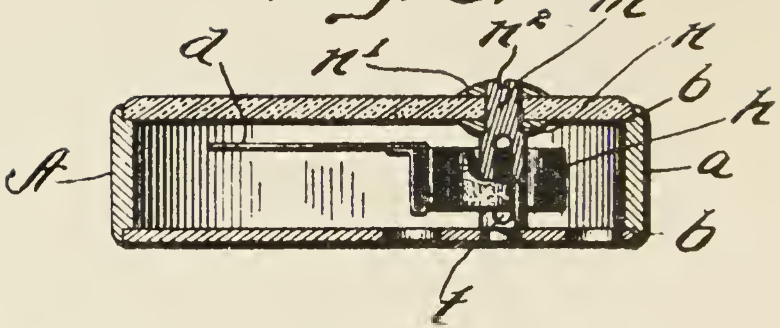
The Top

Fig. 2.



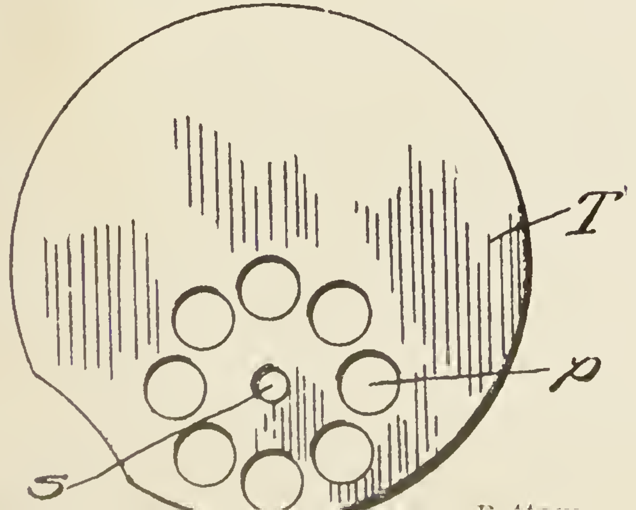
Lower view, bottom out.

Fig. 3.



Section.

Fig. 4.



Bottom

Fig. 5.

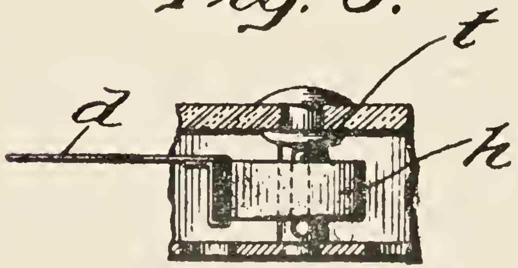
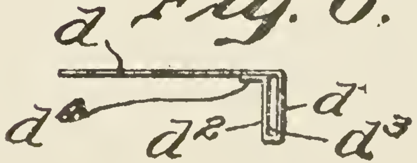
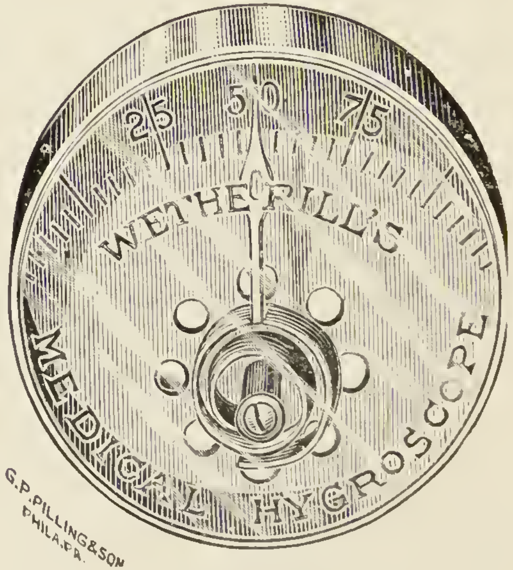


Fig. 6.



Spiral in detail.



Wetherill's Hygroscope.
54th. Model.

ILLUSTRATING THE CONSTRUCTION OF THE HYGROMED.

Other Methods.

Other Ways of Getting the Moisture of the Skin.

Where the Clinical Hygroscope measures the Relative Humidity of the air, the hygroscopic spiral being ⅛ inch away from the surface of the skin,—a piece of 0.3 saturated aqueous solution of cobalt chlorid,—filter paper, when placed upon the surface will take up the moisture, and by the changes in color from a slightly greenish blue to a very light and yellowish maroon,—the Absolute amount of moisture from a definite surface is obtained,—by comparison with a scale of colors not unlike that of Talqvist's for the estimation of hemoglobin, as oxyhemoglobin.

Each color of the circular color scale corresponds to a definite water percentage of saturation of atmospheric air.

(I have made a somewhat similar blood-color scale to read the percentages of hemoglobin, by day- or lamp-light, but that is a different matter.)

(Here a black and white half-tone of the special Cobalt scale with the colored plates may be inserted. The table of water absorptions, to appear later in this paper, is included in this diagram. [Plate 4, page 16.]

Here may be inserted the squared paper representation of many observations on the absorption of water by chlorid of cobalt papers. These tests were made repeatedly, covering a period of several years, the dots represent the observations and weighings with different standard balances. [In table form, page 16.] See p. 64. The resulting line.

This line gives a constant interval of absorption of moisture, into one disc ¾ inch in diameter, Eimer and Amend, special filters,—and for each ten percent. there are 1.4363 milligrammes of water

(Osmic acid paper might be used to detect the oils of the perspiration).

The Colored Paper Method.

taken up. The papers are uniform, but many were weighed to determine accurately for one, which is to be used clinically. Weighings of the paper alone can be made. Tests for the salt alone can be made or calculated.)

After much work and investigation I have come to the conclusion that for practical relative humidity work this scale is the best and most reliable, particularly where only an accuracy of five per cent. is required. It is of much use in correcting the Hygromed, which in turn will give finer indications of moisture.

In taking up and losing moisture these papers gain and lose in weight, as is shown in the following table.

This scale, table, and idea, is explained in my color book. Geo. P. Pilling & Son Publishers 23d & Arch Sts.

%. Relative Humidity	Gain in weight, in Milligrammes.
0	0.0
10	1.43
20	2.87
30	4.31
40	5.75
50	7.18
60	8.62
70	10.05
80	11.49
90	12.93
100	14.36

Page 12, col. 2.

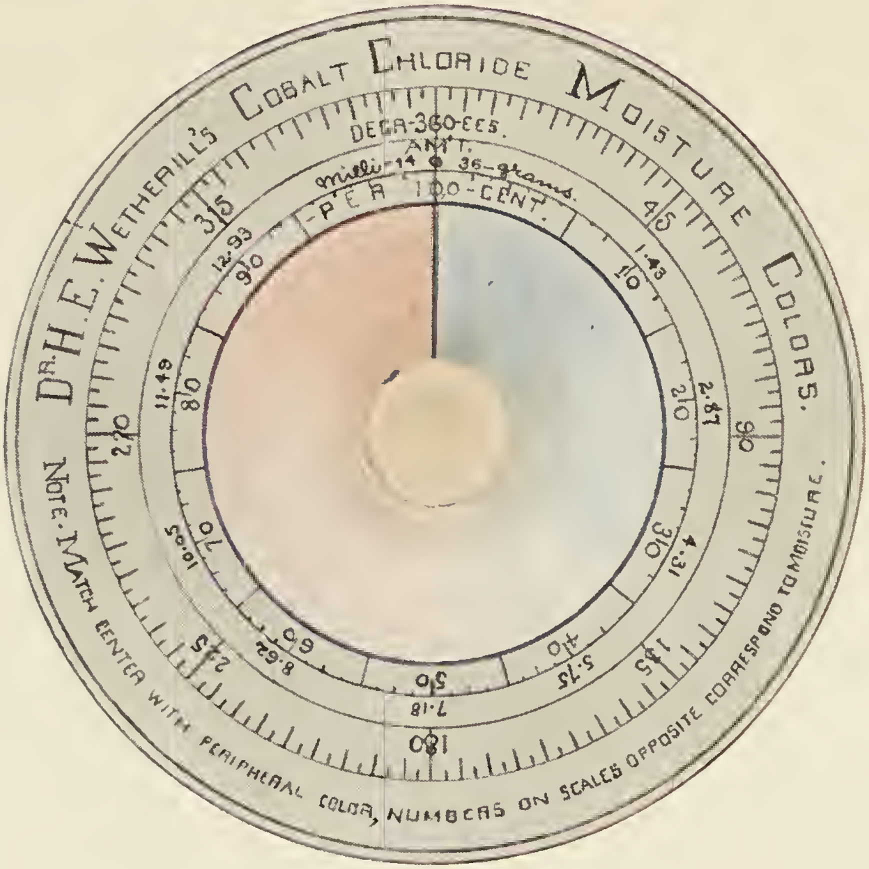
(Referred to at page 15, col. 2.)

Ref. on plate 4, at page 16.

There is a constant interval (1.43 mg.), starting with a weight of the dried paper at 28 milligrammes. (This, 4 Saturated.)

The changes of color are alone due to the changes of moisture causing the

MOISTURE CHART.


Dr. H. E. Wetherill's Cobalt Chloride Moisture Colors.
Note. Match center with peripheral color, numbers on scales opposite correspond to moisture.
DEGR-360-EES.
ANT.
milli-14 36-grams.
-PER 100-CENT.
45
90
135
180
225
270
315
10
20
30
40
50
60
70
80
90
1.43
2.87
4.31
5.75
7.18
8.62
10.05
11.49
12.93

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PRICE 20C.

Plate IV. Hygromedry. Page 16.
Ref. Page 15, Col. 2. See Pages 27 and 58.

skin, under glass, after ten minutes we are able to weigh the moisture given off as told by the change of color. Should there be a sudden and partial change of color, as where the wetted paper becomes suddenly dryer, then a little time will have to elapse until the color becomes uniform, and reliable, then it can be matched.

The disc should then be between glass, celluloid, or wax-paper, so that the moisture throughout remains the same.

The observations have been compared with almost all relative humidity instruments, many times, over a period of several years, and the results are very satisfactory, not only because the papers are compact, and always in order, but because they are economical. A small piece of paper will work as well as a large amount, and this is of value in determining the moisture of internal cavities, as in the getting the difference of moisture between the inspired and expired air.

This is much simpler than the weighing method of Dr. W. Freudenthal, of New York, where the moisture was absorbed into pumice acidulated with $H_2S\ O_4$. (1).

This method is an improvement over the French picture of a little girl whose skirt dipped in cobalt changes in color with the relative humidity. With my scale we are able to obtain finer moisture distinctions by colors.

The paper is useful in obtaining the moisture of the air in such places as incubators, instrument cabinets, static machines, refrigerators, drying kilns, vapor baths, and in fact in an innumerable number of localities.

Where after 100 tests upon normal person's palms the amount was 75 per cent., in disease there was frequently

---

(1) Paper on Etiology and Treatment of Post-Nasal Catarrh, with Remarks on Hygiene of Respiratory Organs; particularly in relation to Humidity. To have a low humidity of 15% tends to Catarrh and then to Tuberculosis. Jour. Am. Med. Ass'n, Nov. 1895.

Ease of Working, Avoiding Calculations.

sufficient difference to indicate the particular pathological condition.

Ordinarily, with the rise of temperature alone, there is drying of the skin, but not enough cases have been tried as yet to express the numerical relation.

In half a dozen cases of Uremia it was found that the patients could not change the color of the paper in ten minutes more than 15 percent., even when held in the palm by the thumb of the opposite hand.

The papers are dried before use, till they represent the color represented by 0 per cent. on the scale. This is done over a stove, electric light, a match, or in a dessicator.

In one case of Diabetes insipidus the paper showed 39 per cent., being used in the regular way.

make conclusions, but it would suggest an extensive trial of this more practical clinical test of the patient's moisture,—for the relations of urine, sweat, and mouth moisture, are very important.

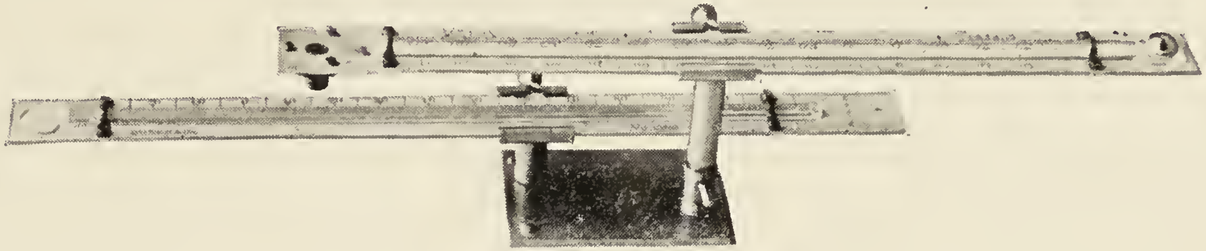
There are many diseases having changes of moisture as diagnostic features, and in them we hope to mathematically express these symptoms.

It is hoped that we may get a better idea of the effect of our diaphoretic medicines and measures, that we may not only know what is the moisture of the hot air in a pack, but also be able to get the moisture of the skin before, during, and after a treatment.

In one case we had a somewhat better idea of the prognosis because the daily dryer condition of the paper in a case of Bright's disease indicated the

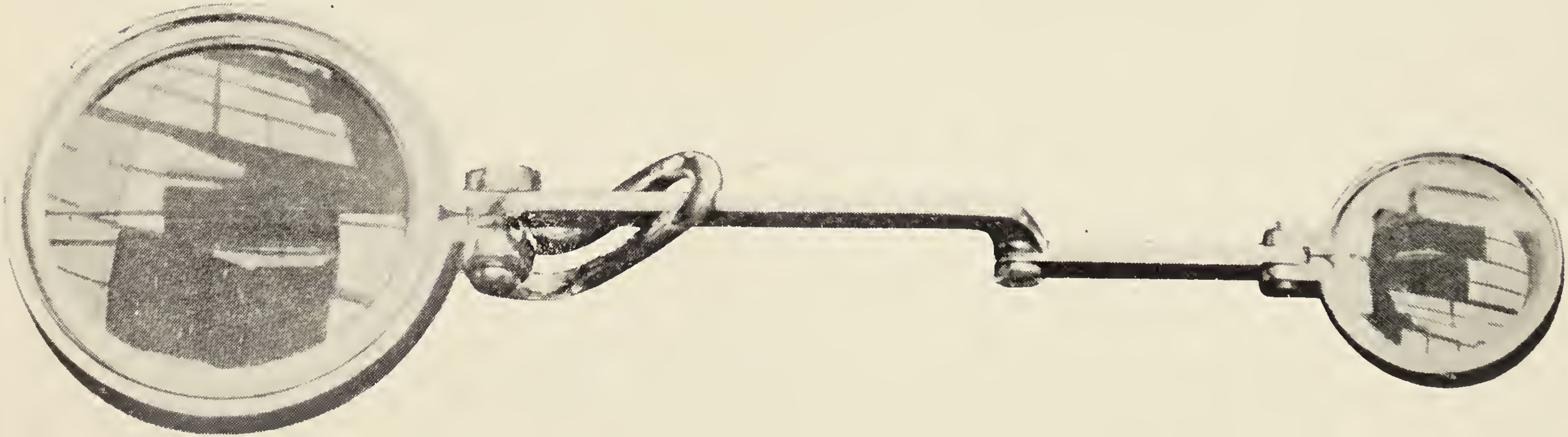
A New Thermometer Base,

(Townsend's)

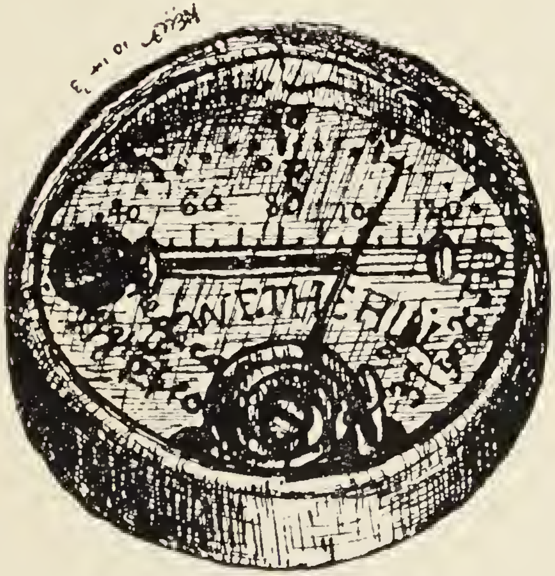


Made by Queen & Co., Philadelphia. Refer to page 29.

A Magnifier for Reading Instruments.

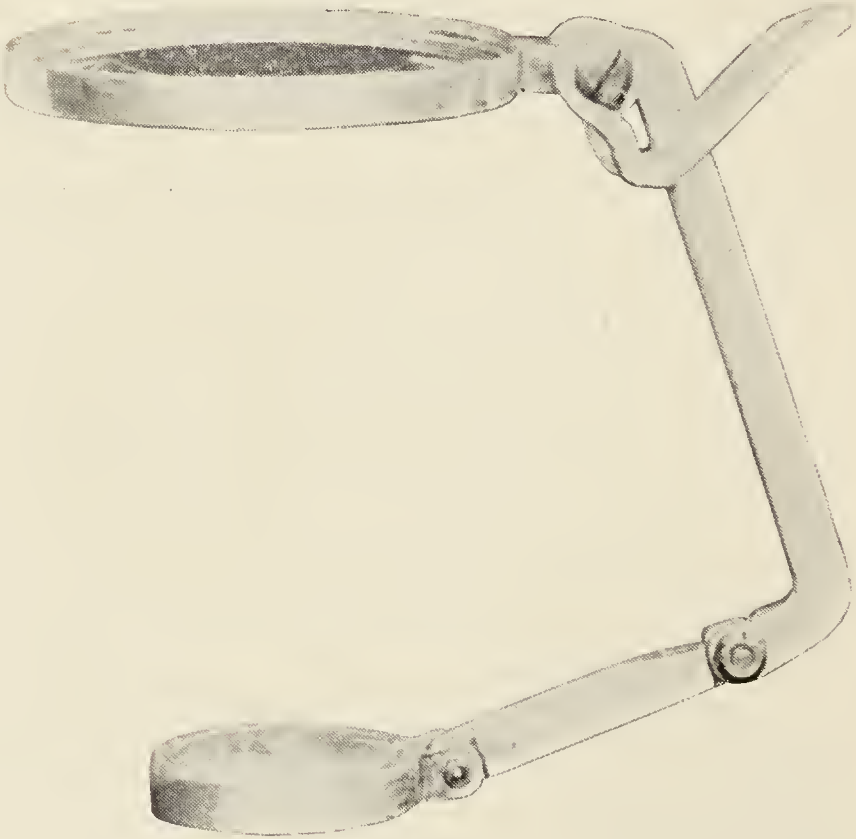


A Sketch of the Hygromed.



Refer to page 12.

Combination Magnifier.



Same as on opposite page, but used as

What we can Accomplish with the Co Cl_2 Method.

test are general. Ref. page 8, col. 1. Page 44, col. 2.

The practicability of this paper method for measuring and plotting the moisture, is in the fact that the busy clinician will not have to stop to weigh the amount of moisture taken up, as used to be done in cups containing sponge, or chlorid of calcium.

The chances for error are slight, and the ability to measure the moisture minutely from very small surfaces is of some importance in neurological localization.

The numbers on the scale read the relative humidity of the air, and at each per cent. there is a constant water amount absorbed. The amount of water taken up by the paper alone is small, the amount taken up by the salt practically causes the whole change in weight, and for practical purposes it is the amount of moisture taken up as the disc used actually is, that enables us to get a gravimetric determination of the perspiration amount.

The solids of the perspiration being but about two percent. are negligable, or can be allowed for.

The scale is for use in ordinary daylight, although lamplight seems to make no appreciable difference, but for uniformity, reflected white light at 45 degrees may be used.

A standard candle in a dark-room may be used, and also excluding screens, like black or white perforated papers, or tubes may be used. These refinements are not essential.

Where there is profuse sweating the exposure time may be reduced, or when the sweat pours out it can be measured in a graduate, as in a case seen by Dr. A. J. Smith.

General Considerations.

The scale is particularly useful for determining accurately by direct observation the moisture of the air, and its results have been more reliable than those made with expensive, intricate, and bulky psychrometers. The scale is accurate to within one percent., and in ordinary use with the average observer should give results correct to within a few percent., relative humidity.

There is no temperature, barometric, or other errors, and the arrangement is a more accurate, scientific and practical application, of a principle long known.

The moisture of the air is a very important factor in all human relations, many times it is of more importance than the temperature, which is better and more generally understood and appreciated.

The moisture of the air is important

bacteria, and in the putrefactive processes.

The following quotation from an editorial in the Jour. Amer. Med. Ass'n, Nov. 19, 1904, page 1557,—is a propos.

"The increase of catarrhal diseases in the winter time, including pneumonia, may be ascribed in some measure to the differences in the humidity between indoor and outdoor air.

"Not only is the dryness of the air conducive to hyperactivity of the glandular structures, but the passing from dry indoor air to moist outdoor air, and vice versa, is a severe strain on the mucous membranes. These facts are of great importance to the physician. For him to regulate the ventilating and heating apparatus of his patients' homes will be a tremendous task, and yet many affections can not be controlled until this important aid to health is properly looked after."

"The Geetzy indoor air moistener has

The Importance of the Subject

Relative Humidity a Matter of Great Concern.

this tremendous task."

They claim page 51, Jour. Amer. Med. Ass'n, Feb. 4 , 1905: "It maintains from 50 to 60 percent. of moisture in the air of the room in which it is operated according to instructions. With this amount of indoor humidity a room is more comfortable and more healthful at a temperature of 65 to 68 degrees than is one with only 30 percent. of moisture, and a temperature of 75 degrees."

Upon putting a dish of water upon the stove, or in the register, is a practical manner of raising the moisture of the air of the room in the Winter.

Dr. Freudenthal laid stress on the importance of this matter in a paper before the International Medical Congress, at Madrid. several years ago; in which he spoke of frequent catarrhs in New York, from this source, and then following various throat troubles, including tuberculosis.[1] See page 17, note.

My moisture scale, particularly when the card has a large central cobalt paper, so that the color can be seen across the room, is especially recommended for keeping the relative humidity constant, and at the proper percent.

We all know how uncomfortable we feel in hot weather with a high humidity,—and how the cold seems to be increased in winter when there is dampness.

A very hot day is more comfortable with a low humidity, and as in Arizona one hardly realizes the temperature; the perspiration is quickly dried, leaving the salts upon the shirt. It is thus essential to equalize the metabolism by drinking larger amounts of water. The cold is well born in the arctic regions on account of the low humidity.

The measurement of the actual conditions of the patient are of importance, even if different people vary under sim-

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(1) "Contributions to the Ætiology of Pulmonary Tuberculosis. Annals of Otology, Rhinology and Laryngology, Feb. 1897. Ueber einige praktische Gesichtspunkte in der Behandlung des Chronischen Nasen und Rachenkatarrhs; Zeitschrift für diätetische und physikalische Therapie. '02-'03, Band VI, Heft 4."

ilar conditions. The higher moisture of the air surrounding the pneumonic person can be kept constant by having the paper show it by being kept pink, a dryness in our instrument cabinet will prevent the rust of tools, here the paper should be kept blue, as in the closets of the static machine and analytical balance—as is done with calcium chlorid.

Placed in the open air, protected from rain-drops, the scale shows the increase of moisture with the oncoming of rain, and as prepared, gives slight and quick changes not possible to detect by the use of other chlorid of cobalt, and many different methods.

These papers have been tried in many climates, they are not likely to fade, but it is best to keep them in a dark and dry place, away from the light, and between wax paper. For ordinary medical work they may be used several times.

When it is desired to know in what moisture certain anaerobic germs are growing a small piece of the disc may be torn off and be suspended in the air, or tube.

(The paper is of use in rifle shooting, wireless telegraphy, in rating chronometers, and in many other ways.)

In practice the skin is wiped before the blued paper is applied—thus should we desire to get an idea of the exsiccated condition in cholera due to the loss of water, or of a similar dryness of the skin from the loss of blood, we would wipe the skin and apply the disc for a standard time, under glass, preferably under a pound pressure.

The paper measures the excretion collected, as a bucket collects water. Thus in the water-soaked skin of a drowned person we might get the amount of absorption in a unit of time, from many localities,—and calculate the absolute condition, whereas if we used a medical hygroscope the result would be in the relative humidity of the air surrounding the body.

Dr. J. M. Anders, who wrote a thesis on the transpiration of moisture by plants, recently asked me if the cobalt papers test was a quantitative one, and I said, "Yes, but to get the whole amount of moisture excreted a day we would have to continuously observe many different places and know the area of the surface of the body, and the different amounts from each place, and their variations." (*J. M. A. Cat. Ridgeway Library.*)

The paper measures by color, as the thermometer shows temperature by expansion, but both give quantity with the relation to time and area, one in weight, the other in calories.

For measuring surface areas of an irregular nature my Rotameter and Protractor is recommended. This is a disc calibrated with twelve inches on the circumference on one side, and as a 360-degree protractor on the other.

In general, as with the temperature, a standard place may be tested, and the occasional records, going with the total amount records, will give a practical clinical method of recording the moisture.

With the Hygromed the moisture of the air near the body is measured, and with the test paper the amount of water given off by the body is determined.

As referred to before, Draper has weighed the whole body to test the moisture amount. Page 8, Col. 2.

Another absolute way of determining the moisture from the skin, but a tedious process, is the weighing of the moisture taken up into Calcium chlorid, or into dried sponge, that may be put in cups, as illustrated.

(Here the mechanical drawing may be

inserted. Photographed;—and blue printed. (See p. 36.)

There is some room for electrical tests of the moisture, but as yet little has been done in this line, and at present the methods are more of laboratory than of clinical interest.

The famous French neurologist J. Charcot referred to the decreased electrical resistance of the skin in Exopthalmicgoitre, but from my tests it would seem that the increased moisture of the skin was the real symptom, and the resistance decreases tremendously with the moisture on the surface. (P. 43, Col. 2.)

We used a Queen & Co.'s Wheatstone bridge, balanced with a galvanometer, the whole apparatus can be carried like a satchel.

I devised an electrical resistance apparatus to measure ohms by the resisting upon the resistance of a fluid. In the latter one has to make intermittent tests to allow for electrolysis, and in the former to be careful the line is not rubbed off.

An electrode should be used having poles a standard distance apart of about ⅛ inch. If much more than this is used considerable current is required to overcome the high resistances of the dry skin. If then many batteries are used the danger of error from skin electrolysis is increased. Reversing the poles will help this matter.

For laboratory tests the De'Arsonval, or other delicate galvanometers, may be used.

The Kent, Volt-Ameter is a portable instrument that may prove to be of use, using standard batteries, for measuring the Ohms in terms of Volts or Amperes.

ance between the poles on the skin, at standard pressure, and time.

A recent telephonic method of measuring resistance seems good, because the single wire Wheatstone bridge is balanced when the sound is least, and besides, having the advantages of using both galvanic and Faradic currents, no galvanometer is required, and the instrument is economical, and compact.

The methods depending upon these electrical principles, particularly where the more bulky apparatus are used, seem rather impracticable, and as I have not as yet done much with them they need not detain us further.

What we want is an instrument or method that will work well, quickly, constantly, one that is simple, durable, easily adjusted, easily understood by the novice nurse,—and a method that is economical.

In reference to the Hygromed and Cobalt paper methods, it must be remembered that the absolute and relative measurements depend upon different units, and that each has its correction variables. The relative and absolute humidities are mathematically convertible, and the chlorid of cobalt scale can be calibrated in terms of absolute absorption, as well as in relative humidity.

While still on the subject of methods of measuring moisture, I wish to just mention a compensating Hygroscope made of wood and whalebone.

There are many things that show moisture changes, the coiling desert plants, the resurrection plant, the mosses, the Equisitaceae, and others that have been mentioned, elsewhere. D. P. R. 16,568. Calliburce's English patent, No. 13,044; also in my notes, and articles. See plate 2, at page 11. Ref. Our State Army and Navy Jour., Oct., 1904. Vol. 7, No. 9.

Browning's spectroscope for detecting the moisture of the air may be mentioned.

In the construction of temperature spirals to give the (t) or (t^1) thermometer temperatures, which refer to the dry and wet bulb readings, either platinum and silver, or steel and brass, may be used, as in my non-breakable thermometers. Refer to plate 5, No. 1, at page 26; also to page 66.

The Practical Correction of the Hygromed.

(Refer to note, page 36) (See plate 7 and its back)

The spirals of these instruments are specially made so as to overcome the ordinary inaccuracies present in the German spirals. For instance the pillar

tion, and the adjustment on the spiral corrects for the amount of motion due to the effect of relative humidity on the modified egg-skin. The final correction is made by comparing the instruments with standardized ones, which may be corrected with different relative humidity apparatus or with the special chlorid of cobalt scale devised for the purpose.

It is well to have the instruments corrected as it reduces the observations of various observers to a standard of Relative Humidity. However, comparative results are valuable clinically.

In examining the instrument look to see if the spiral is centrally placed on its axis, and that the indicator is always radial to the post as an axis, the needle at 50 per cent. should occupy a medial position in the length of the five per cent. graduation lines.

Psychrometer Comparisons.

horizontal position whenever possible, and any error of balance caused by the different positions of the indicator should not be over one percent.

These little instruments are very sensitive, and delicate, so it is best to compare them with the chlorid of cobalt scale that accompanies them, before they are used. The instruments are durable.

If, however, the instrument has been corrected within three months, and has not been allowed to fall, or be otherwise injured, it is not so necessary to make a preliminary correction. Plate 4, p. 16.

A practical way is to determine by experiment what is the ordinary moisture of your breath, and the moisture in different parts of your body, and then make a test to see if the instrument is in good working order.

This will do well for the higher moistures, but for the lower ones the instrument may be put in the sunlight, or at night near something warm, like a stove, or near an electric light.

A desiccator can be used, and preferably one with a flat top, so that you may read the instrument.

Unless a sling Psychrometer is near the Hygromed, or the relative humidity is uniform thereabouts it is unreliable to depend upon them, for by actual tests it has been found that the relative humidity varies in spots, therefore I generally use the chlorid of cobalt scale adjacent to the hygromeds.

A psychrometer spun like my Torkrit, near to the hygromeds, would be better. See plate 5, Nos. 2 and 3, at page 27. See plate 7, page 47. See page 61.

The final error of these instruments as sent out by the manufacturers, with the little correction chart in the top of the case, should not exceed three percent., and some, like the certificates of clinical thermometers, go out correct.

A Physical Standard of Comparison.

(Here the picture of the Sling Psychrometer may be inserted.) Plate 5, No. 1, page 26.

This is an Aluminum framed Sling Psychrometer, and probably one of the best of this class of moisture instruments. The thermometers are both standards.

In selecting one observe the corrections of the well crystallized, fully contracted thermometers. The thermometers preferably should not be calibrated for several years after they are blown, and they should both be correct, or corrected.

Observe for the true dry bulb reading and correct for any differences due to the size and shape and nature of the bulbs.

These matters are refinements. See Encyclopædia Britannica under "Diffusion." (Ref. page 48, col. 2.)

wet and dry-bulb thermometers are used. The best tables for these instruments give the corrections for the aneroid or a mercurial barometer. Reference, page 47, col. 2.

Although the results are often very accurate, v. s. to within 0.5 of one per cent., still the observations are sometimes out as much as ten percent.—particularly in high humidity conditions.

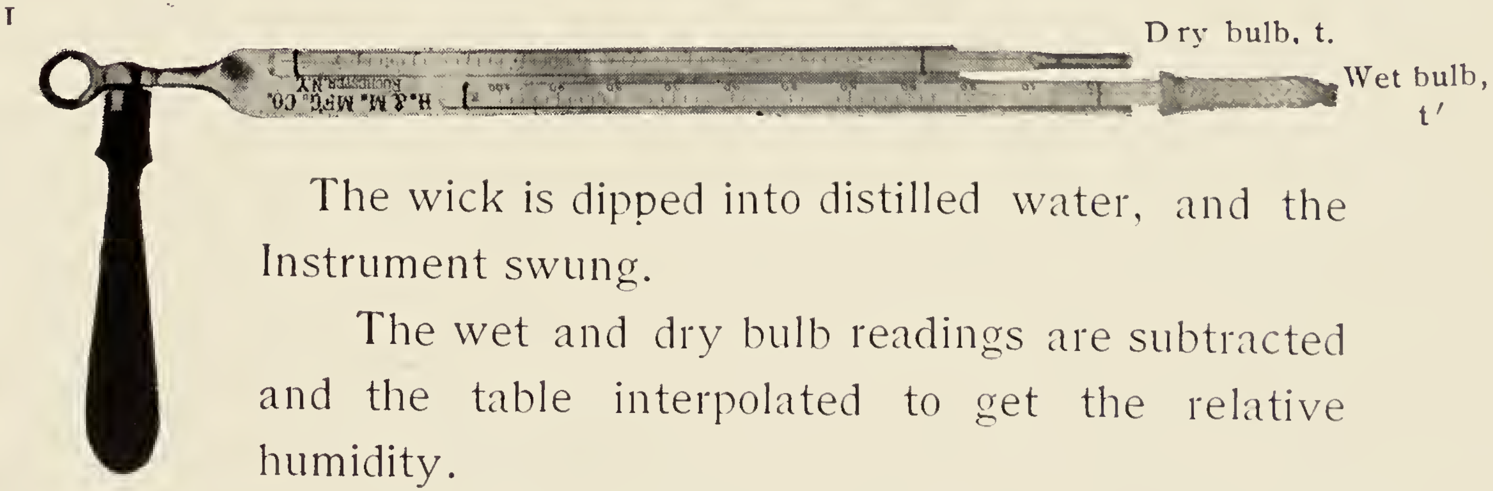
As the determinations by the color scale are very uniform throughout the scale, and as they seldom vary more than 2 per cent., and are less trouble to obtain, it is a better method for standardizing the medical hygroscope, should it be necessary to do that.

The photograph of the psychrometer was made one-half size. About one-fourth size in the half-tone. Plate 5, No. 1, page 26.

Some Psychrometers used for testing the Hygromed, after it has been manufactured.

Useful Types of Hand Swung Psychrometers.

THE SLUNG PSYCHROMETER.



The wick is dipped into distilled water, and the Instrument swung.

The wet and dry bulb readings are subtracted and the table interpolated to get the relative humidity.

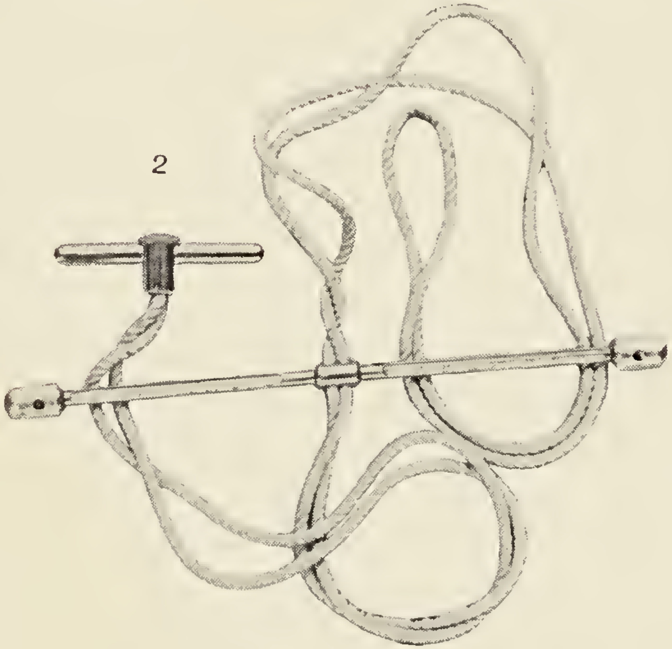
Plate 5. No. 1. Ref. to page 28 (Cols. 1 and 2)

See Universal Thermometer, back of Plate 7, at p. 46.

See table Plate 7; Page 47.

The Torsion Psychrometer.

2



Page 27, Col. 2.

An Improved Form of the Psychrometer.

Torsion Form by H. E. Wetherill.

This instrument also is the best dew point apparatus, and contains maximum and minimum thermometers. It is most accurate, and complete. **Price, $5.00.**

For Sale by

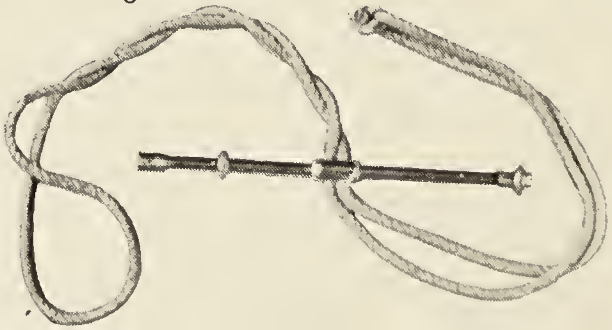
GEO. D. FEIDT & CO.,

528 Arch St., Philadelphia.

The Thermometer Settler

is made to settle the mercurial column of difficult thermometers, but short chemical thermometers may be inserted and the instrument used as a swung or unswung Psychrometer, using the appropriate tables.

3



Chart, for 3 Hygromeds.) See p. 64.

The moisture record charts are handy for making Hygromed corrections. See page 64.

The first, although an example of what is frequently found, is larger in extent than ordinary, yet is not too excessive for a useful machine. The position of the zero correction can be altered by turning the post with a screwdriver, or pocket-knife, and it is best to have this at a point where the instrument is most used. The numbered dots represent the single observations, ten in all, and it will be observed that the average correction line follows them closely. I prefer twenty observations distributed throughout the scale, more particularly, where the instrument is to be used, but not caring to strain the spiral unnecessarily, at the extremities of the scale, especially at the lower moistures.

The other plottings are of two instruments, numbers 10, and 14. They are both very good, particularly the former, which stayed so, as long as it was under observation, before being sold, some months, as I remember.

The correction line don't go over 3 per-cent. from the normal central straight line.

What We Desire to Do.

Knowing that the perspiration symptoms are only approximately reported it is often valuable to more mathematically express the moistures of the skin, with the hope that diagnostic data may be obtained that in future will be of prognostic import.

To measure the moisture is a way to get a better idea of the treatments used.

This means that much work on a field

What can be Done with a Complete Hygromed.

of pathology, and primarily on that of hygiene, will have to be covered, as was done—and is still being done with the clinical thermometer. †

The more one works in a special field the more interested he is apt to become, so I can not hope to at first interest the casual reader in the finer points, where concomitant readings of Barometer, Thermometer, Evaporimeter, Anemometer, Radiometer or light, and other factors pertain. (Vaporimeter, page 65.)

I do not propose to burden the paper with these more or less unimportant points. Neither will I here publish extensive tables which few persons read:—the moisture, and other similar curves can be described in less space than the charts would take.

The Things That Can Be Done.

The things that are of common use, and all of which can be observed with the medical hygroscope, with thermometer, are as follows;—in their utilitarian order.

1. The moisture of the patient.
  (a) Moisture curves.
  (b) Averages of general observations all over the body.
  (c) Local observations.
  (d) Sagittal comparisons.
  (e) Breath and Mouth moisture.

2. The temperature of the patient.
  (a) Surface, at the same time as the mouth reading,—or separate.
  (b) Mouth. Read in position.

3. The moisture of the air.
  (a) In the room.
  (b) Out of doors.
  (c) Comparison with Cobalt paper as a check on observations with the medical hygroscope.

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† On the Panamanian Isthmus, while taking moisture records in malarias, we not uncommonly got tem-

Practical Results.

4. The temperature of the air, and of other things.

(a) In the room.
(b) Bath.
(c) Out-doors.
(d) Food, etc.
(e) Calculations with moisture and temperature factors, such as absolute humidity, and deficiency of moisture.

A more careful study of a case is that found in the chart of Mr. F. F., accompanying, here more factor curves are considered, but we have not gone into great minutiae. (Page 37, col. 2.)

The numbers to the right are the orders of the values of the curves in practice.

This chart may be put in; made by my H_2SO_4, red fixing process.

This is the number of curves generally run on my important cases, and represents the practical limit.

The Obtaining of Results.

After about three thousand tests of one kind and another, in health and in sickness, I find that the normal moisture of the palms of the hands is 75 percent.

The observer will find the various moisture amounts in different localities, and it is an aid to know the person's normal amount in a definite location.

I have started out by testing diseases where perspiration and sweating symptoms seemed to be most prominent, and although in order to say much one should have many results in each condition, still I mention some of my results with the hope that other investigators may refute them if they can, and add more material to the list.

Cases.

Some Results Obtained.

At the Philadelphia Hospital in 1895 I thought that the dryness of the skin of Uremics would be interesting to measure.

At that time, with a very imperfect instrument, which took 15 min. to work, I was able to show how dry or moist the skin was, and since then **Uremia** has been one of the most fruitful diseases in giving diagnostic, prognostic, and treatment—indications and results.

Now I can say from the careful and prolonged observation of not less than six cases, and more casual examination in a number of others, that the moisture gradually decreases with the oncoming of Uremia, and a sufficient time is given to institute corrective treatment.

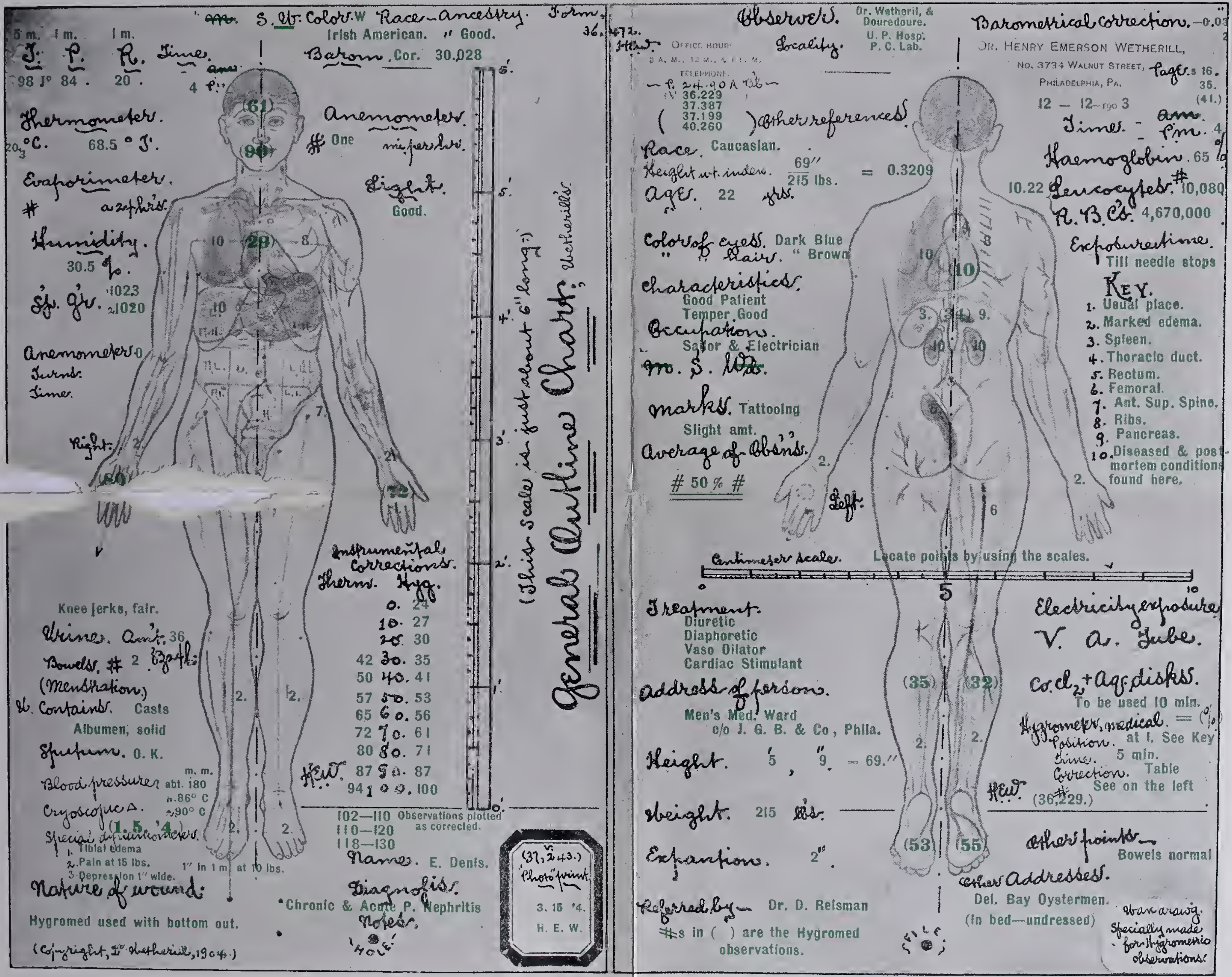
A mild case would give 60 percent., a severe one 30 percent.,—and fluctuations of the patient's condition between these points are indicative of his conditions.

At the same hospital, one mortal case of Phthisis pulmonalis conscientiously tested himself for a period of three months; and in fact the good fellow died with the instrument in his hands, his last efforts being in the cause of science.

He had considerable Hectic-fever in the afternoon, which was followed at night by sweats that the instrument recorded, running up to 85 percent. When the moisture curve was up—the temperature curve was down, and *vice versa*.

The latter relation of the temperature—moisture opposition has been frequently observed in fevers, and in Typhoid the daily decrements of moisture are nearly as pathognomonic as the increments of temperature.

There may occasionally be local causes



~~M.~~ S. W. Color. W Race-ancestry. Form,
Irish American. " Good.

5 m.	1 m.	1 m.	
T.	P.	R.	Time. ~~am.~~
98 1°	84.	20.	4 P.

Barom. Cor. 30.028

Thermometer.
20 3 °C. 68.5 ° F.

Anemometer.
One mi. per hr.

Evaporimeter.
# a zephir.

Light.
Good.

Humidity.
30.5 %.

Sp. Gr. 1023
2 1020

Anemometer. 0
Turns.
Time.

Instrumental Corrections.

	Therm.	Hyg.
	0.	24
	10.	27
	20.	30
42	30.	35
50	40.	41
57	50.	53
65	60.	56
72	70.	61
80	80.	71
87	90.	87
94	100.	100

H.E.W.

102—110 Observations plotted
110—120 as corrected.
118—130

Knee jerks, fair.

Urine. Am't. 36 3 zp 4h.

Bowels. # 2

(Menstration)

U. Contains. Casts
Albumen, solid

Sputum. O. K.

Blood pressure m. m. abt. 180

Cryoscopic Δ. n. .86° C
a .90° C
(1. 5. '4)

Special Hygrometer.
1. Tibial edema
2. Pain at 15 lbs.
3. Depression 1" wide.

1" in 1 m. at 10 lbs.

Nature of wound:
Hygromed used with bottom out.

(Copyright, Dr. Wetherill, 1904.)

Name. E. Denis.

Diagnosis.
*Chronic & Acute P. Nephritis

Notes.

'HOLE'

(This scale is just about 6" long:)

General Outline Chart; Wetherill's

(37, 243.)
"Photo" print
3. 15 '4.
H. E. W.

36. 472.
H.E.W.

Observers. Dr. Wetheril, & Douredoure.

Locality. U. P. Hosp. P. C. Lab.

Barometrical correction. -0.03 2

Office hours
8 A. M., 12 M., & 6 P. M.
Telephone.

Dr. Henry Emerson Wetherill,
No. 3734 Walnut Street,
Philadelphia, Pa.

Page. s 16. 35. (41.)

— P. 24. 90 A Obs —
V 36.229
37.387
37.199
40.260
( ) Other references.

12 — 12 — 1903

Time. ~~am.~~ pm. 4

Race. Caucasian.

Height wt. index. $\frac{69''}{215 \text{ lbs.}}$ = 0.3209

Age. 22 yrs.

Haemoglobin. 65 %

10.22 Leucocytes. # 10,080

R. B. C's. 4,670,000

Color of eyes. Dark Blue
" " hair. " Brown

Exposure time.
Till needle stops

Characteristics.
Good Patient
Temper Good

Occupation.
Sailor & Electrician

~~M.~~ S. ~~W.~~

marks. Tattooing
Slight amt.

Average of Obs'ns.
50 %

KEY.
1. Usual place.
2. Marked edema.
3. Spleen.
4. Thoracic duct.
5. Rectum.
6. Femoral.
7. Ant. Sup. Spine.
8. Ribs.
9. Pancreas.
10. Diseased & post-mortem conditions found here.

Centimeter scale. Locate points by using the scales.

Treatment.
Diuretic
Diaphoretic
Vaso Dilator
Cardiac Stimulant

Electricity exposure.
V. a. Tube.
Co. Cl$_2$ + Ag. disks.
To be used 10 min.

Address of person.
Men's Med. Ward
c/o J. G. B. & Co, Phila.

Hygrometer, medical. = (%)
Position. at 1. See Key
Time. 5 min.
Correction. Table
See on the left
H.E.W. (36, # 229.)

Height. 5', 9" — 69."

Weight. 215 lbs.

Expansion. 2".

Other points—
Bowels normal

Other Addresses.
Del. Bay Oystermen.
(In bed—undressed)

Referred by— Dr. D. Reisman

#s in ( ) are the Hygromed observations.

'FILE'

War drawing.
Specially made for Hygrometric observations.

where the result will be that the moisture curve will go up or down independent of the temperature condition.

The whole run of a fever chart will generally be opposite to the temperature curve, and when the patient recovers, the moisture curve returns to the person's moisture normal.

Crises of Pneumonia in which they were marked by perspiration have been observed in a few instances.

I mention one case, of Mr. B., where the moisture curve went up at the crisis, and then dropped suddenly, the great oscillation of the needle being marked by a fluctuation of 30 percent.

I read recently, Jour. Amer. Med. Ass'n, 1894, p. 634, Dr. Horace G. Wetherill's account of Chronic Adhesive Sclerosing Peritonitis. Here he reports that a year before the disease was diagnosed it was noted that the sweat-glands did not functionate. It would have been valuable to have recorded the skin moisture, for a subsequent indication of the condition in others. Connective tissue contractions perhaps constricted the sweat ducts,—and from my general experience in clinical hygroscopy I should judge that the moisture in this case would have been about 55 percent.

In a few operations of Hypodermoclysis, the medical hygroscope pointed higher and higher, with the introduction of the normal saline solution. The record was from 55 percent. to 95 percent.;—in the case of D. W.; shot on the field; in the Philippine Islands. A considerable amount was injected, probably four quarts,—but the exact numbers are not at hand.

In one interesting case of Chronic Parenchymatous Nephritis just recently completed, after a nine weeks daily

(Valuable in Plotting Fevers from a Moisture Standpoint.) Of great use in Uremia.

record, I find that when the man was most uremic, the record was 55 percent., and when he was better, at five different fluctuations of his condition, the record went up to 64 percent. (Left palm.)

Just a day before death from Uremia the record was 43 percent., nothwithstanding that he had been given morphia to relieve his distress,—morphia tends to give a higher measurement of the moisture of the skin.

In this case, which I had the privilege of watching, through the courtesy of Dr. Alfred Stengel, of Philadelphia, the moisture of the breath was found to be increased 10 percent., or 90 percent., indicating that the body was in this way trying to get rid of its moisture through the edematous lung. He was generally edematous, and where it was the worst the medical hygroscope indicated the lowest. A series of ten readings all over the body averaged 50 percent., against 65 percent. for health. This was during one of his better periods.

(Here may be inserted Mr. E. D.'s chart of hygroscopic readings. This is a special outline figure chart. The numbers on the outline figure represent the corrected moisture amounts.) Page 34.

Refer to page 44, col. 1.

Refer to pages 63 and 64.

This man also had valvular heart disease.

I found in three instances, for the hot packs or vapor baths given, that the moisture ran up to 90 percent., against 95 percent. for Turkish bath results on normals, and that when he was badly off the treatment did not have this much effect, but what is more interesting—within a few hours after the treatments, the moisture went down to about 50 percent., depending upon his conditions, and that it generally took several days for it to regain its former positions.

In this case the man when relaxed by sleep gave but a few percent. rise of the relative humidity, whereas in health there is often four times this amount.

In two cases of Uremia at the Pennsylvania Hospital, both had been equally severe, but one had had four hours previous to the tests with the clinical hygroscope, a sweating bath.

The record in the former case was 40 percent., while in the latter, which had the diaphoretic treatment, the instrument gave 53 percent.

This would indicate the efficiency of the treatment, the better condition of the second man, and that the effects of the sweating had not yet worn off.

At the same time and place two control tests were made upon healthy men, giving two normal records, indicating that the instrument was in order, and showing the relation of the skin conditions existing between the normal and the diseased.

Such wide variations are so far from any usual variations on similar parts of the body in the healthy individual that the numbers here indicate the pathological condition. Here the air humidity was constant.

It would seem that Bright's disease affects the functionating of the sweat glands, for when the kidneys do not act the skin should reciprocate, which it does not always do.

Where the kidney function is in abeyance as well as that of the skin, the condition is all the more serious.

Where the moisture of the skin is less than that of the air, I have found the strument to go down. This was well shown in the Philippine Islands where

Recently at Panama in 3 Anesthesia cases, I noted marked fluctuations of the needle of the Hygromed.

the Relative Humidity I observed to be 85 percent., for several weeks together.

These conditions with the instrument are not often met. *

In one case of relaxation following Typhoid fever, the moisture of the skin was ten percent. above normal, and a dose of 1-100 gr. of Atropine sulfat temporarily lowered the moisture record in the palm 4 percent. It had been running at 80 percent.

The Hygromed should be of value to the dermatologist, in studying the eliminations from the skin.

The desiccating results of dusting powders such as starch, chalk, alum, oxide of zinc, and subgallate of bismuth, etc.; should be investigated.

The effect of diaphoretics like Pilocarpin, Spiritus Aetheris Nitrosi, and Liquor Ammonii Acetatis, should be studied, and the relation of the perspiration to the use of diuretics, should be examined with the hygromed.

In the case of Pseudo-angina-pectoris, affecting an army officer, we observed asymmetries of moisture, particularly the difference of the moisture on the legs. At times, more particularly at crises, the one side would be covered with perspiration where the other was comparatively dry. Not having the figures at hand I record the moistures in words, and this shows how much better it would be to numerically and more minutely describe these symptoms. (Reference, page 40, col. 2. Page 55, col. 1.)

Where we plotted the amount of the urine and its specific gravity, we were better able to understand our cases.

With a high specific gravity the amount of perspiration was increased, as is normal in Summer.

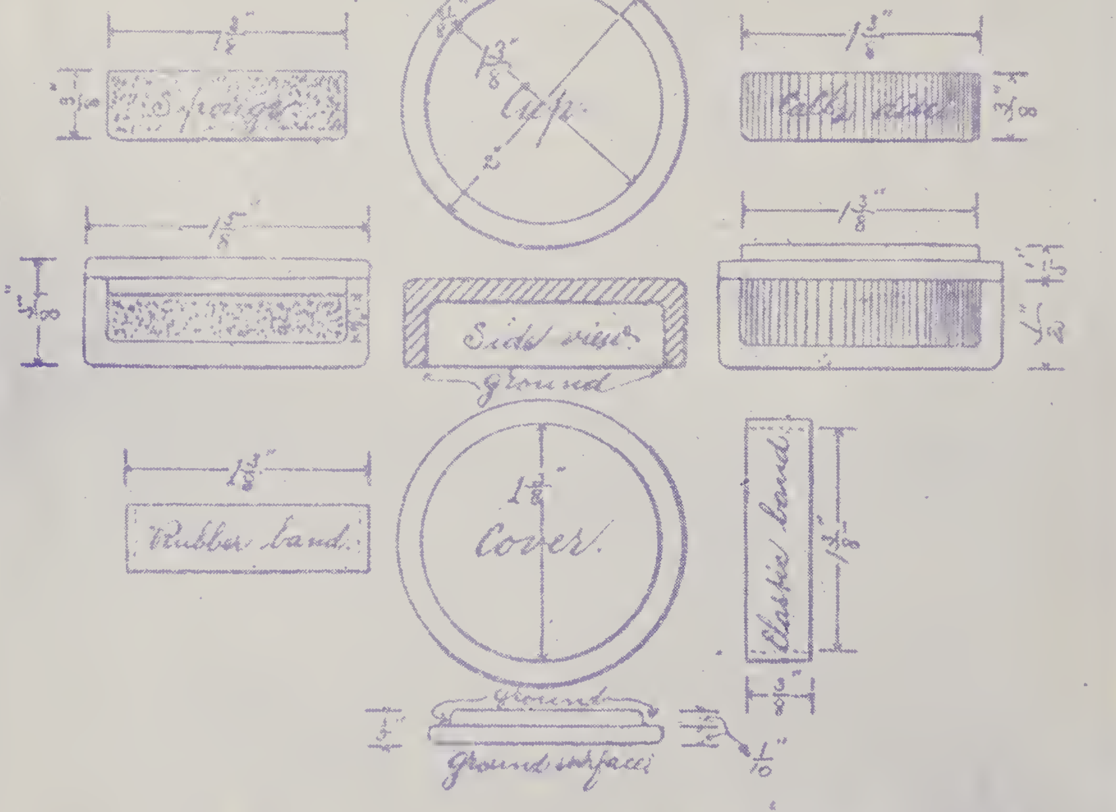
The following quotation, from a letter,

---

* Note.—The opposite is generally the case, in very arid countries where the moisture of the skin sends he hygromeds indicator upwards, as usual. It is well here to test the spiral to see if the great reduction of he humidity has changed the instrument, in which case it should be corrected. See page 26.

Sweat Cup Outfit.

Moulded in Glass, Annealed.



Scale: full size.

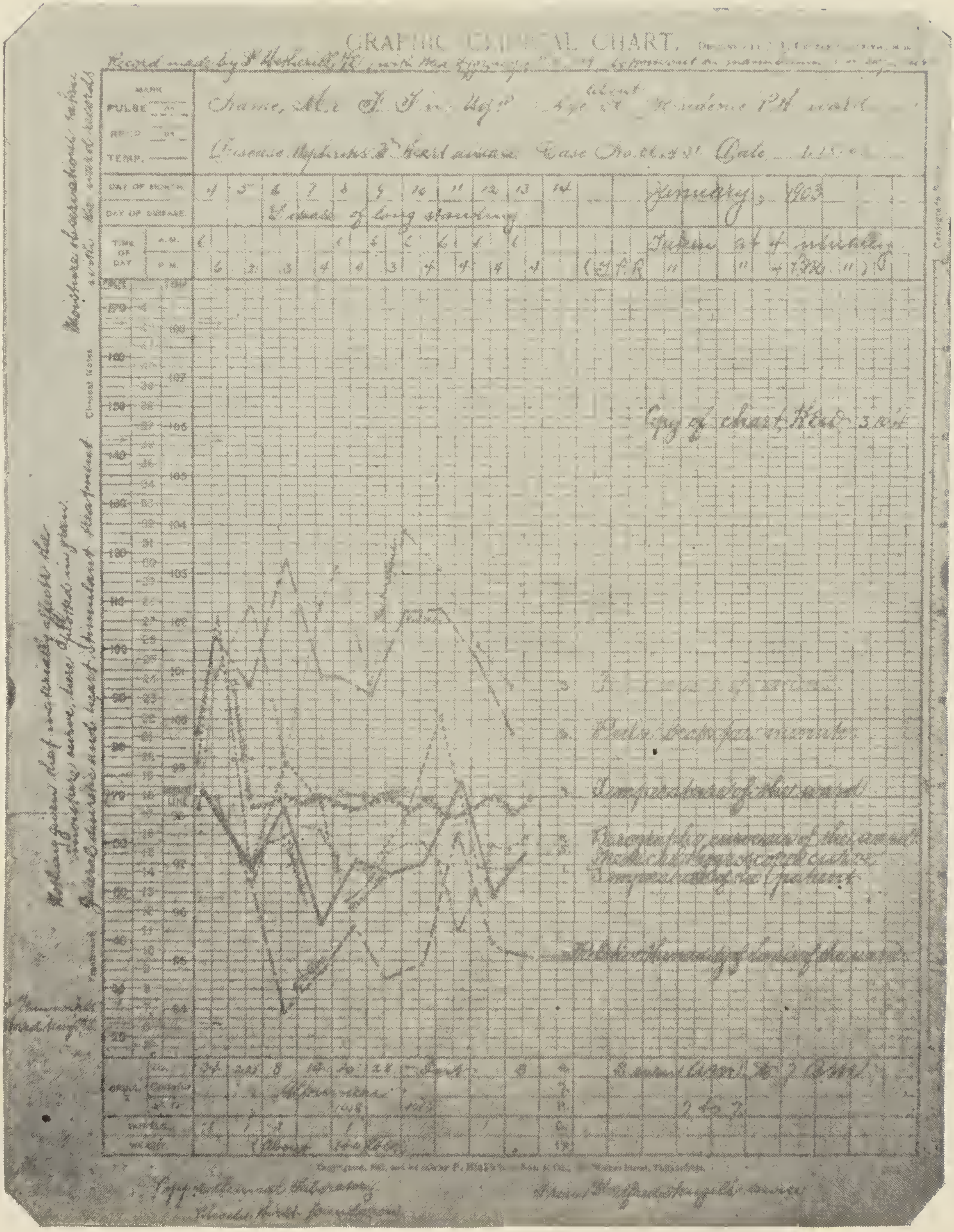
H. Emerson Wetherill M.D.,
3734 Walnut St., Phila.

MAR 14 1904

#37,390

For the gravimetric estimation of the amount of moisture excreted.

See page 24, col. 1.


GRAPHIC CLINICAL CHART.
PULSE
RESP.
TEMP.
DAY OF MONTH
DAY OF DISEASE
TIME OF DAY
A.M.
P.M.
January, 1903

Page 37, col. 2.

bears on this matter.

"November 13, 1903.

Dear Doctor Wetherill:—I found your paper very interesting and I suppose we shall see it in some other available form.

The fact that in summer one loses so much by the skin, and in winter so little, must have some influence on the health, and these certainly are conditions which in later days have been neglected so far as study is concerned. Yours truly,

(Signed) WEIR MITCHELL."

In this note I might refer to Dr. Wm. Osler's letter in which he asks if the methods are of practical value? (I believe so, and furnish those results to confirm my beliefs. H. E. W.)

Also in answer to Dr. B. Oettinger's inquiry:—"Can the results on a case be continued." (The nine weeks Nephritis case, and the three months Phthisis case, together with the fact that one of the hygroscopes I have had for twelve years is still in order, would indicate this. W.)

I wish here to acknowledge the encouragement received in particular from Dr. John H. Musser, and for his note of Nov.; 13, 1903, in which he states, "Many thanks for your very valuable communication. I will be only too glad to read it carefully and put in operation its suggestions."

We had expected a case of Uremia to die sooner than it did; for he was passing but three ounces of urine a day, he did not do so at that time, for the skin was temporarily compensating, with a rise of medical hygroscope curve.

This case is referred to in this article elsewhere, page 31, col. 1.

(Here the chart of Mr. F. F. may be examined. The heavy line in green on the original chart, is the moisture line, showing that these observations may be plotted on the clinical chart.)

See special chart, and data, pages 63 and 64.

The average run of the whole moisture line is below normal, a pathological amount. Note the opposition of the movement, of the curves of moisture of the air of the ward, and the barometer at the same place.

The Clinical excursions of the indicator are so in excess of any 10 percent. normal variations in the palms, that they become of diagnostic import.

In cases of moist shock the readings were about 90 percent. There is an indication in this that would suggest the making of post-operative records.

The bodies of people as they generally live are rather constant, to within a few percentages, so that ordinarily with the patient in bed, or walking around, as doctors and nurses see them, there is no variation of the moisture amount, except that which has some significance. Of course little allowances have to be made for exercise, ingestions of food, water, alcohol, etc.

There seems to be a normal diurnal change of moisture not entirely accounted for by the daily change of temperature.

Where observed in a few cases it was three percentum lower in the evening. In one case the fatigue of the person was accompanied by an increase of moisture in the palms. I refer more particularly to mental fatigue, not muscular, in the latter case.

With the hygromed an important general indication is that where the curve varies much from a rather straight and uniform line there are indications of abnormality and of malaise.

I have used my Rotameter and protractor for measuring the clinically plotted lines, and find it of value; the lines are run over, as you would follow the course on a map.

The following notes of a case of unusual interest are worthy of consideration. The patient sought advice on account of excessive sweating.

Mr. T. F. R. Univ. of Penna. Hospital. Examined by invitation. Observer, Dr. H. E. Wetherill. Service of Dr. Jas. Tyson.

The journal of the case runs as follows.

2. 6. '3. Hygromed on left chest, anteriorally, 3d rib, mid-clavicular line, 80 percent. Sweat visible, and of a musty odor.

Barometer, 767 m. m. Thermometer in the ward 73 degrees Far. Relative humidity of the ward, 26 percent.

2. 10. '3. After having taken Atropina for the rapidity of his pulse, and to counteract the sweating; the hygromed, in the same position, was 75 percent. Barom. 766 m. m. Thermom. 70 degrees Far. Relative humidity of the ward, 34 percent.

2. 11. '3. Hygromed, 69 percent. Pulse, 114. Respirations per min. 22. Temperature about normal. T., P., & R., about normal all along. Barometric pressure in the ward, 742 m. m. of mercury. Temp. 67.8. Humidity of the ward, 63 percent.

Perspiration not visible, not such an odor as on 2. 6. '3.

Here we have a lower moisture, in spite of the lower temperature, and the higher moisture of the ward, which of themselves, if anything, would tend to give a higher skin moisture. Where the day is colder the skin is less active.

The moisture of the skin is usually considered perspiration till it becomes visible, and then it is called sweat. (See Classification.) Pages 50 and 51, cols. 2.

This is a case of suspected Aneurism, the sweating the patient says, comes on occasionally.

Diagnosis.
Diuretic,—and Diaphroretic-Drugs,—and Treatments.
Other Uses.

2. 13. '3. Moisture near the skin, with the hygromed, 76 percent. He is sitting in a little sunlight, has just had a drink of water. T., P., & R., normal. Barom. 762 m. m. Temp. 72 degrees F. Moisture of the air of the ward, 38 percent.

Urine has a trace of albumen. Sweat has a musty odor, particularly when the hygromed shows 80 percent.

Note on the eye. Sub-hyaloid retinal hemorrhage. Highly myopic. Chest examination. Area of dullness around the upper part of the sternum, in excess.

Both radials are about the same in pressure.

Patient goes home, at least temporarily.

Conclusion, in this case.

That the Hygromed represented the perspiration and sweating conditions as they were, but in a more mathematical manner than could have been done by the hand or eye.

That the effects of the Atropina given were shown by the Hygromed. It would have been interesting to have tested for asymmetry of readings on different sides of the body, as a difference is frequently noted on corresponding parts of the body, in aneurism.

Meteorological and personal conditions have apparently little bearing here, thus the T., P., & R. were rather constant, as well as were the air conditions in the ward, in so far as not materially affecting the moisture readings.

Note. In the case of the army officer mentioned, suffering with Pseudo-angina-pectoris, it was observed that one side of the body averaged 8 percent. higher than the other. Refer to page 36, col: 2.

Were it the forehead, armpits, or some

other locality that perspired profusely I would not attach so much importance thereto, as people often have a special part from which they perspire in excess of other places, but where there is a bilateral asymmetry of the perspiration, as in this case, or in paralysis, aneurism and Syringomyelia, and when there is local vasomotor disturbance, then there is greater clinical significance.

Studies of the Carnivora are interesting, the cuticles of cats and dogs are about equally dry.

In the flank of a dog the moisture will be 30 per cent., while his breath shows 90 percent., conditions which if found in the genus Homo would immediately suggest Uremia. Dogs perspire from the soles of their feet. The Hygromed is constructed so as to exclude hairs, to facilitate work upon animals, and on the hairy parts of people.

A reading of lower than 50 percent. in the palms of the hands of the average man or woman is apt to be of serious import.

The thickness of the palmar cuticle makes little difference, and ordinary amounts of dirt on the hand seem to make little or no difference,—in fact an observation taken of a woman's hand through her black kid glove gave but a few percent. lower than the usual 75 percent.

On a man wearing a heavy driving glove, lined with wool, the hygromed gave a reading about 10 percent. below what is usual on the palm itself.

One case of Diabetes insipidus gave a low record of 40 percent., while another case which I took to be D. mellitus gave a high record of 83 percent. The former case was passing over a bucketful of urine a day, and this would indicate that most of the moisture was given from the body in this way. He was much shriveled in appearance and had lost considerable weight. There is here an indication for differential diagnosis,—one would not expect to find the moisture of the breath high here, as is likely to be the case in Uremia,—in which condition the skin is also dry.

Several hundred cases of quotidian malarial fever, some of which were not of distinct type, but at times tertian—gave valuable results, for we could tell the oncoming of the sweating stage and prognosticate more accurately. It was a comfort to the patient to know when he could expect to be out of his fever and chill.

Besides, the instrument gave us a better idea of the effects of the treatments. Where ten grains of Phenacetin were administered, its effect of increasing the perspiration was shown by the medical hydroscope curve, and when the rise was noted, it was several hours before we could have told it in any other way, for the instrument measures something that our senses can not detect.

In this case we refrained from giving any more medicine for we saw that the result we were aiming for had started to come about, but were it not for the instrument we certainly would have given more of this drug that has some depressing influence upon the heart.

Of this series of cases two were particularly striking. The men came into the hospital with temperatures about 106 degrees Far., and with moistures about 40 percent. With their sudden defervescence in several hours the moisture curve became hyperhygrographic; v. s., 90 percent. The temperature curves came down with the going up of the moisture curves.

In one man the open instrument was placed upon the manubrium, and it might be stated here that in about twenty-five tests I have found the record there practically the same as that of the palms of the hands,—the instrument recorded the relative humidities as they were, and it looked like a steam gauge pulsating with the changes of humidity, as the pressure-gauge responds to the changes of pressure of pounds to the square inch in a boiler.

So sensitive was the instrument that with the rhythmical movement of the patient's breast the changes of relative humidity of the part could be obtained.

I have used a special magnifying glass, of moderate power, to read these uncovered instruments, as they are responsive to the approach of one's fingers or body. See page 62, "Adds."

The extended view is as a plain magnifier for short distances, and in other views, when both lenses are used, the observations are made from a distance.

The pictures of this combination monocular Galilean telescope, magnifier, and range-finder, are half-size. (The range apparatus does not concern us here, but it depends upon the principle of the 1 degree angle made by the half prism. See plates at page 18.

In three cases of Exophthalmic-goitre the cutaneous moisture was found to be increased 10 percent., and this would account for the decreased electrical resistance that Charcot of France reported. (P. 24, col. 1.)

In four cases of Pemphigus vulgaris contagiosa acuta, on Luzon, P. I.—as an etiological feature as well as a sympton, an increase of 10 percent. of the cutaneous moisture was noted.

In Syringomyelia, and in Hemiplegia, asymmetries of moisture were noted, where the isohygroscopic lines were altered from the normal,—in which condition parts similarly placed, on either side of the sagittal line of my special hygroscopic chart, are the same.

Reference can here be made to the chart of Mr. E. D.'s case, before mentioned, page 34. Chronic,—and Subacute, Parenchymatous Nephritis. The observations on the body averaged 50 per cent.

In six cases of Hemiplegia I have always found the moisture record on the paralysed side lower,—and from five to ten per cent.*

One unusual case did not show this. It was a case of Unilateral Hemi-hyperhydrosis that I had the opportunity of testing through the kindness of Dr. J. H. W. Rhein, of Philadelphia: at the Orthopedic Hospital. Here the paralysed side was hyper-hydrotic, and an average of five readings simultaneously taken, with their small errors first applied, gave ten percent. higher on the affected than upon the normal side.

Although, as indicated before, it is early to draw conclusions, for they may be refuted,—still it is significant that so far, such a similarity of results in the same conditions, seems to point to an ability to aid in classifying disease by the use of the moisture record.

Ref. page 8, col. 1. Ref. page 18, col. 2.

Can We Depend Upon These Observations?

In answer to this pertinent question I say yes, and make the following remarks.

---

* Note.—See Weisenburg's statements under Vasomotor disturbances; J. A. M. A. 2, 25, '5. p. 605. A hemiplegic was dryer on the affected side, and did not transpire so much there.

Reliability, Meteorological Standards.

We certainly have wanted for a long time a method that will enable the nurse to report the moisture more scientifically, and in a practical manner. Even were this done with an error of 10 percent. it would be of use, as is the usual dependence on Hemoglobin, and in some other useful clinical tests.

But we can get much better results in medical hygroscopy than this, some instruments give a limit of possible error of ± 2 percent., and this means that most observations in the clinical scale from 20 percent. to 100 percent. do not vary over one percent.

The instrument may be erroneous a few percentums but the corrections at each part of the scale are applicable, as with the clinical thermometer.

(Reference may here be had to some correction charts.) Ref. pages 63 and 64.

My earlier observations are comparable with my more recent ones, although the limits of error in the former were in the vicinity of ten percent.

The uniformity and constancy of the readings is sufficient for clinical judgment. The instrument immediately used a second time gives the same result. Five minutes is used so that the oscillations of the needle will come to rest at the true result.

Even were we working with an arbitrary scale our variations from an abscissa would give us comparable results.

But the methods are founded on calculable meteorological constants, and our standards of absolute and relative humidity give us a datum to work upon, so that the results of all the works of all physicians are comparable.

This is important for the statistical compilation of the data. It is not necessary to go into the numerous involved,

Complexity of Moisture Theories Need not now Hamper the Usefulness.

theoretical, and hypothetical relations, of the various factors associated in this work, for it is meant for the practical physician, to help him to a better diagnosis, and were the instruments cumbersome, expensive, or the methods involved, they would soon be dropped from every-day use.

I have omitted the methods used at first, where calculations of variable complexity were involved in using apparatus depending upon the principles of—

Allnard's, August's, Assmann's, Calliburce's (p. 11), Cat-gut one, Chemical Hygrometer, Cobalt Pictures, Card one, Damp Detector, Daniell's, Dine's, Ferdinand's, Hygrodeik (Lloyd's), Hygrograph, Hygrophant, Lambrecht's, Leslie's, Mason's, Mithoff's (Plate No. 1), Monner's, Regnault's, Saussure's (Plate 2,—No. 3), Tagliabue's, Wurster's (p. 10), and other hygrometers, hygroscopes and psychrometers. With the present methods there is no necessity to bother with the tension of aqueous vaper tables, the barometrical, thermometrical, and latitude corrections, such as are involved in meteorological computations tables, such as those of the United States Weather Bureau, Department of Agriculture, No. 235, Guyot's Meteorological tables, Smithsonian Institution, 1859, and The Smithsonian Meteorological Tables. 1897.

A few guiding references are here inserted to give the student a glimpse of this mathematical side of the subject.

The scope of this paper does not take up this side of the question, but it must be remembered that the work is based upon these meteorological data. The work has been well carried out and often gone over, till the present publications of the U. S. Government represent the matter very correctly. Probably the Smithsonian tables are the best to date. This physical subject is a life-study in itself, and fortunately for the medical profession it need not be gone into so deeply, in order to get good

QUEEN & CO., INC., PHILADELPHIA.

RELATIVE HUMIDITY TABLE.

Air Temperatures.	Difference Between the Dry and Wet Thermometers.																																					Air Temperatures.
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	
30	100	89	78	67	57	47	36	26	17	7																												30
35	100	91	82	73	65	54	45	37	28	19	12	3																										35
40	100	92	84	76	68	60	53	45	38	30	22	16	8	1																								40
45	100	92	85	78	71	64	58	51	44	38	32	25	19	13	7	1																						45
50	100	93	87	80	74	67	61	55	50	44	38	33	27	22	16	11	6	1																				50
55	100	94	88	82	76	70	65	59	54	49	43	39	34	29	24	19	16	10	6	1																		55
60	100	94	89	84	78	73	68	63	58	53	48	44	39	34	30	26	22	18	14	10	6	2																60
65	100	95	90	85	80	75	70	65	61	56	52	48	44	39	35	31	28	24	20	17	13	10	6	3														65
70	100	95	90	86	81	77	72	68	64	60	55	52	48	44	40	36	33	29	26	23	19	16	13	10	7	4	1											70
75	100	95	91	87	82	78	74	70	66	62	58	55	51	47	44	40	37	34	31	27	24	21	19	16	13	10	7	5	2									75
80	100	96	92	87	83	79	75	72	68	64	61	57	54	51	47	44	41	38	35	32	29	26	23	20	18	15	13	10	8	6	3	1						80
85	100	96	92	88	84	80	77	73	70	66	63	60	56	53	50	47	44	41	38	36	33	30	28	25	22	20	17	15	13	11	9	6	4	2				85
90	100	96	92	88	85	81	78	75	71	68	65	62	59	56	53	50	47	44	41	39	36	34	32	29	26	24	22	20	17	15	13	11	9	7	5	3	2	90
95	100	96	93	89	86	82	79	76	72	69	66	63	60	58	55	52	49	47	44	42	39	37	35	32	30	28	25	23	21	19	17	15	13	11	10	8	6	95
100	100	97	93	90	86	83	80	77	74	71	68	65	62	59	57	54	51	49	47	44	42	39	37	35	33	31	29	27	25	23	21	19	17	15	14	12	10	100
105	100	97	93	90	87	84	81	78	75	72	69	66	64	61	58	56	53	51	49	46	44	42	40	38	35	33	31	30	28	26	24	22	20	19	17	15	14	105
110	100	97	94	90	87	84	81	78	76	73	70	67	65	62	60	57	55	53	50	48	46	44	42	40	38	36	34	32	30	28	27	25	23	22	20	19	17	110
115	100	97	94	91	88	85	82	79	76	74	71	69	66	64	61	59	57	54	52	50	48	46	44	42	40	38	36	34	33	31	29	28	26	24	23	21	20	115
120	100	97	94	91	88	85	83	80	77	75	72	70	67	65	62	60	58	56	54	51	49	47	45	44	42	40	38	36	35	33	31	30	28	27	25	24	22	120
125	100	97	94	91	88	86	83	80	78	75	73	70	68	66	64	62	59	57	55	53	51	49	47	45	43	42	40	38	37	35	33	32	30	29	27	26	24	125
130	100	97	94	91	89	86	83	81	78	76	74	71	69	67	65	62	60	58	56	54	52	50	49	47	45	43	42	40	38	37	35	33	32	31	29	28	27	130
135	100	97	94	92	89	86	84	81	79	77	74	72	70	68	65	63	61	59	57	55	53	51	50	48	46	45	43	41	40	38	37	35	34	32	31	30	28	135
140	100	97	95	92	89	87	84	82	79	77	75	73	71	68	66	64	62	60	58	56	55	53	51	49	48	46	44	43	41	40	38	37	35	34	33	31	30	140
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	

TABLE FOR SLUNG PSYCHROMETERS.

Plate 7. See page 47; Wetherill's Hygromedry.

Price of this Reduced Correction Table, 3c.

(OVER)

THE UNIVERSAL THERMOMETER

AND

HOW IT IS OPERATED

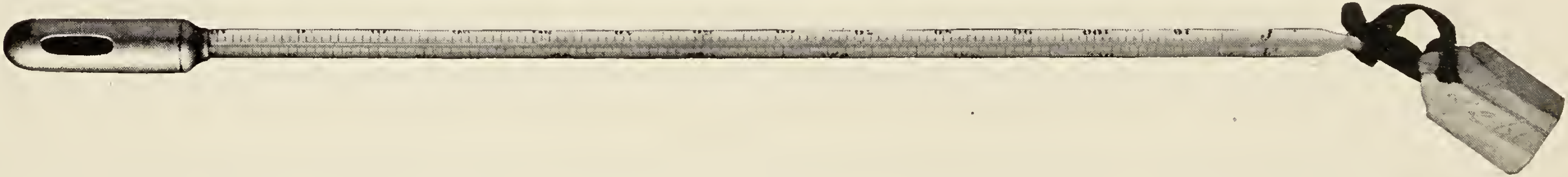
BY HENRY EMERSON WETHERILL, M. D., PHILADELPHIA.

This instrument does all the work ordinarily expected from a Thermometer, although sometimes more labor is required, owing to its greater simplicity of construction. The following may be observed :

The Dew Point. By using a few drops of ether in the aluminum cap, it takes the place of the Daniel's Hygrometer.

The Temperature of the Air—and of Other Things, as with ordinary thermometers of various ranges.

The Wet Bulb Reading, by using the muslin or wick cover of the mercurial bulb.



The instrument may be used as a slung or unswung psychrometer. When the instrument is spun, by holding the cord as a centre, the rotation reading is determined.

Pure water is used on the cover, and for swung readings the table on the opposite page is the proper one to use.

From the above observations, practically all thermometric matters may be calculated. The metal-protected form of the instrument may be packed with cotton, in its metallic bulb, when deep sea temperatures are to be observed. A line is attached to the hole at the top of the instrument. The cap over the bulb is removable.

These instruments may be made with an aluminum cap, and the brass tubing the whole length of the thermometer, in which case the instrument needs no packing box. It is durable, compact and portable.

REGULAR PATTERN - - - $2.50

Reference—Practical correction of the Hygromed, p. 26 ; Wetherill's Hygromedry.

PLATE VI.

(OVER)

References for Those who wish to go into Refinements, Calculations, etc.

results in medical hygroscopy.

Therefore, we will not take up the discussion of Glashier's factors used in the obtaining of the dew-point, nor go into the development of Apjohn's empiric formula for the determination of the elastic force of vapor corresponding to the dew-point.

These moisture problems are at present based on tests, and upon empiricism, and constitute one of the most elaborate scientific, and mathematical subjects it has been my pleasure to peruse.

A rather practical reference to this work is to be found in "A Handbook of Hygiene," by A. M. Davies, Charles Griffin & Co., London, 1895, page 463. Most of the books on hygiene refer to the matter briefly, but at sufficient length for the physician to be guided in correcting the Hygromed.

Regnault's observations are pioneer, and often referred to. Memoires de L'Academie des Sciences de L'Institute de France. Tome XXI, 1847.

In making the tables for giving the pressure of aqueous vapor in saturated air the Smithsonian Institution uses Dr. Broch's reductions of the observations of Regnauldt, Travaux et Memoires du Bureau International des Poids et Mesures, t. I, p. A 19-39.

Hygrometric observations on mountain stations. Dr. J. Hann, Zeitschrift fur Meterologie, vol. IX, 1874, p. 193-200.

The elevation corrections are not important ordinarily for medical purposes. I have generally used those of the Weather Bureau referred to. (See p. 28, col. 2.)

References on this matter may be looked for under meteorological heads, most of the civilized nations have contributed something.

There are many tables. That of Queen & Co., Philadelphia, is ordinarily useful to the physician for obtaining the relative humidity from the observations of the wet and dry-bulb thermometers. See plate 7, p. 47. (My reduction of the table.)

Meteorological Hygromedry.

For those desiring a practical glimpse of the subject I refer them to Weather Bureau pamphlet 235, price 10c., in which the values of the relative humidity and the temperatures of the dew-points have been computed by Prof. Ferrel's formula, see Annual report Chief Signal Officer, 1886. Append. 24. pp. 233-259. (Get the abridged tables, 1901.)

As dryness generally goes with cold, and Glashier's factors are not so reliable here, reference is made to some correcting observations. Annual report Chief Signal Officer, 1891. Appendix No. 10, pp. 351-383.

There are many little points in moisture meteorology that do not have a very important medical bearing. The refraction of the air in navigation observations, R. H. in ordinance, the formation of dew on dust particles, moisture in the tobacco industry, the different results obtained as to whether you use a very fast or very slow revolving psychrometer, and many others, but these are getting too far from the subject of my paper. (See p. 28, col. 2.)

No practising physician is going to bother with useless calculations for which he would have to specially train himself, and even if he did care to go into this side of the question, which, however, has its scale of usefulness, he has not time to carry it out at the bedside where the results are wanted then and there.

In clinical medicine we do not want any scientific things that have to be carefully worked out under standard conditions in the laboratory,—as for instance cryoscopy of the urine as a test for albumen in nephritic urine,—results which even after all the time and trouble are very questionable.

This side of hygroscopy I have worked upon from a theoretical interest, but am more particularly interested now in getting useful records with the practical

NOTE.—(It may be of interest to note, as this book is going to press, October 31st, 1905; that Dr. Charcot of France, reports from the Antarctic, a condition found, similar to that at Cape Horn,—namely, on fair days there is a regular diurnal variation of humidity. It would be of interest to study this in its relation to man; and the records of the Hygromed.)

form of the instrument.

It does not take any large amount of skill to make these tests, the nurses can make them with but little instruction, and the interpretation of the results are generally self-explanatory.

These cases reported will be sufficient to show what can be expected. I have now made enough records to be able to help myself in cases that appear; where there seems that there is a likelihood of moisture observations giving indications;—and these cover a large range of condions.

It is important to note that half a dozen various forms of the instrument gave considerable uniformity of results, varying mainly in the time required for the test,—now with a uniformity of manufacture this difficulty has been overcome. (Various pictures may be inserted.) Ref. plate 2, p. 10. Ref. page 11, col. 2.

Many tests and models were made before the best materials and arrangements for the construction of the instruments were determined upon, in this I have been guided by the factors for materials mentioned in the Smithsonian Physical Tables, 1897.

Apart from the general use in medicine, this instrument is applicable as an ordinary Hygroscope, and not only are moisture readings of use to the physician, but also to the botanical ecologist, scientist, and in fact to everyone.

The Prospects for Hygromedry.

Although we do not claim that the use of this instrument will cure anybody, still it is by its use that we expect to be aided in our work, as does the clinical thermometer so materially help us.

Ordinary, and additional uses of the instrument will suggest themselves, thus should we wish to see that our static machine has dry air surrounding it, the instrument will make the test, so also will we be able to keep our instruments from rusting, by having the attendant keep the dry calcium chlorid renewed in our instrument case, so that the hygroscope will always point to 10 percent.

The room can be kept moist where there is a case of pneumonia, and the refrigerator can be examined to see if there is dryness.

Suggestions for the medical application of the instrument in different diseases, or hygienic conditions, will present themselves—or can be culled from any medical or surgical text-book, particularly those good on symptomatology.

The following brief summary of more marked conditions of moisture, to be met in diagnosis, is given as a guide for future work.

The numbers given and made blacker, represent the diagnostic values as the results of my observations in general; and the figures that are not made heavy, represent what would be expected.

(Ref. p. 39, col. 2.)

A Classification.

CUTANEOUS OUTPUT.

(Perspiration), [Sweat] & Sebum.

(0 per cent—75 per cent.) [75 per cent.—100 per cent.]

Normal variations, palms of hands; 70-80 per cent.

(Refer to books on symptomatology.)

SWEAT.

Composition of all of it, as given in Charle's (p. 349), Physiological Chemistry, quoted by Halliburton.

H_2O 98.88 percent.
Solids, 1.2.
Salts, 0.57.
NaCl. 0.22-0.33.
Other salts. 0.18. alkaline sulphates,

phosphates, lactates & KCl.

Fats. 0.41 fatty acids, and cholesterin.

Epithelium. 0.17.

Urea. 0.08.

SEBUM,

has in it fatty particles, epithelial cells, cholesterin crystals, proteids, including casein.

Chemically abnormal substances occur in sickness, and through treatments. Reference may be had to works on the Chemistry of the perspiration and sweat. (Surg. Gen's. Catalogue.) (Col. Phys. and Surg., Philadelphia.) (Index Medicus.)

ANIDROSIS. 0.0 per cent. to 75 per cent.

Prolonged or temporary, 0-75 percent. Impaired nutrition of the skin, 0-75 percent. Dry air. Anidrotic drugs. With, or without fever. Lack of water. Profuse hemorrhage, 30 percent. Paraesthetic meralgia, generally local Cholera, 25 percent. Contracted capillaries. Tensions of the skin, as in anasarca, and myxedema. Hemianidrosis, in hemiplegia, 45 percent. Acute digestive disorders of children. First day of the eruption of the exanthemata. Diarrhoea and dysentary, 10-60 percent. In diabetes, 50 percent. Nephritis, 50 percent. Uremia, 30 percent. Scleroderma, and dystrophies. Ichthyosis. Vasomotor nerve derangements, 10-75 percent. Anidrosis with local inflammation. Abstinence from water, and fluids in general. Locally in Syringomyelia.

HYPERHYDROSIS, 75 to 100 percent.

(Ref. page 39, col. 2.)

Prolonged or temporary, 75-100 percent.. exertion, 90-100 percent. Heat, 90 percent. Moist air, 85 percent. Sudorific drugs, 85-95 percent. Miliary fever. Trichinosis. As in rheumatism, 88 percent. Phthisis pulmonalis, 75-100 percent. With and without fever. In tetanus. Emotion, 75-100 percent. Collapse, 90 percent. Weakness, 90 percent. Crises, as in pneumonia, 80-85 percent. Relapsing fever. In pyemia, variable. Ulcerative endocarditis. Dyspnoea, 85-90 percent. when the capillaries are dilated. Hemi-hyper-hydrosis, in some hemiplegias, 90 percent. In Milium, moisture retained under the epidermis, but one case gave a reading about normal. Ague, 90 percent. Carcinoma. Miliaria rubra. Infectious and septic conditions, variable. Pain, 85-100 percent. Vasomotor nerve derangements, 75-100 percent. Hot baths. Hot drinks. Cold drinks. Ingestion of water, by mouth or skin. Fluids. Alcohol. Exophthalmic-goitre, 86 percent. Generally found in chromidrosis. Locally in Syringomyelia. Other.

ASYMMETRIES OF MOISTURE. 25 to 95 per cent.

Prolonged or temporary. Hyperhydrosis, or anidrosis localis. Syringomyelia. Dif. 5-20. Neurasthenia. Migraine. Neuralgias. Hysteria. Malarial paroxysms. Pseudo-angina pectoris. Rachitis. Aneurism. Pressure on nerves. In the insane, 87 percent. Paralyses. Suppurative parotitis. Vasomotor nerve derangements. Anidrosis, with local atrophies. Changes in the sweat amount from affections of excretory fibers and centres, as well as changes in the sweat ducts, glands, and adnexa. Chromidrosis is generally localized. Other.

UNUSUAL MANIFESTATIONS.

Generally local. Prolonged or temporary.

Chromidrosis. Yellow, as in jaundice.

Classification.

Brown, as in hysteria. Blue, Hysteria. May be bacterial, like the red skin pigment seen at times, due to Bacillus prodigiosus Red hematidrosis.

Stercohydrosis, in constipation, fecal odors coming out through the skin.

Uridrosis, containing urinary substances, as compensatory to the kidney's action, especially containing urea. U. crystal'lina.

Bromidrosis, odorous, due to fermentation and decomposition.

(Reference is here made to Breitenbach's chart, No. 52. Bacillus saprogenes, of bromidrosis of sweating feet. It is small red-stained, slightly curved: X 1000.)

Hydrobromidrosis, moisture and odor. 92 per cent.

Dyshydrosis, difficulty of the moisture in gaining exit. As cheiropompholyx.

Oleodrosis. oils of perspiration and sweat in excess. After the ingestion of much fat, by skin or mouth.

Decreased amount of oils.

Menidrosis, as in vicarious menstruation.

Sweat pouring out of the skin, so that it can be collected in a cup, or in the special curved, ground stoppered, bottle I designed, having a stand. The opening is put over the skin, or it goes on the finger a standard time.

Dr. A. J. Smith mentioned an interesting case of this kind, seen in Texas.

Phosphoridrosis, phosphorescent sweat, as in late Phthisis, in Miliaria, and in those who have eaten putrid fish.

The vapor form of sweat, as seen after exercise on a cold day, due to the condensation, where the dew-point of the vapor has been reached or exceeded. Seen in horses and men.

(The bear skin trimmings of the Esquimaux's clothing, where the clothing joins, is made so that when the per spiration freezes in icicles, it can be knocked off, by tapping the hairs.)

The Greenland natives I noticed had air holes in several parts of the body of their "Timiac," and the ears of the animal's fur making the headpiece, also allowed the exit of the body moisture.

Much discomfort has been given Arctic explorers when the perspiration in the hide freezes while they are asleep, the icy folds of the fur dig into the skin on commencing work upon awakening.

In hot and arid countries the salts of the perspiration are often found on the skin, and show well on a dark shirt.

The hygroscopic salts in the fibers of the clothes take up moisture during a damper evening, and in putting on the soiled clothes in the morning they feel wet.

Drug eliminations, from the skin. Infectious diseases, Typhoid, Measles, Uremia, Racial peculiarities, Other matters.

CLOSURE OF PAPER.

The permanent value of the methods depends upon how much research has been done, so I do not think it entirely inappropriate to close this work with the following rather poetical, although not particularly literary-allusions?

The latter part of these lines is more particularly applicable to the mathematical expression of the perspiration amount, with the Hygromed.

An Appeal to Figures.

When bickerings and dickerings, with mankind,
Over quibblings and dabblings of the mind:—
Annoys one's-self, and others, too,

Seek solace in figures, and calm your woe.

Further Research.

Although you can't get right,
  You may know the reason why—
With the use of least squares,
  You may the errors try.

As Spencer has said, when we want to know—
  With figures we express, in order to show:
When factors don't show, what we know,
  We don't fairly express what we thought we knew.

We may express ourselves in language trite,
  Use metaphore, similes, and climax right;
But who believes our statements true
  Unless our instruments or tables show.

I call all doctors to medically express,
  By instruments of precision with absoluteness.
And as we depart from art, to a science pure,
Use figures instead of words, more and more.

It is desirable to have others collaborate in the large field of Hygromedry, so we invite you to join the increasing band of medical hygroscopists; we will be pioneers that will explore the little known country of Moisture Diagnosis; we must climb the mountains of Opposition, and cross the rivers of Criticism and Prejudice. We will reach the land of Numerical Usefulness.

——FINIS.——

February 17, 1905.

HENRY EMERSON WETHERILL, M. D.,

3734 Walnut St., Philadelphia, Pa.

ADVERTISEMENT OF HYGROMED.

DIRECTIONS FOR THE HYGROMED.

Its use is very simple, both to the patient and by the Physician, or Nurse. The bottom of the instrument has perforations in it and these are laid over the part to be tested, the moisture pouring out of the body fills the aluminum box and makes the needle record the moisture. I have frequently taken the moisture and temperature without awaking the patient. This can not always be done with the clinical thermometer. The instrument is left on the surface a standard time of five minutes. Like the clinical thermometer is does no harm to leave it too long, and some instruments will record in a fraction of a minute. When the patient has had a bath five minutes before, the skin should be wiped with a towel. This I always do for uniformity of technic. The instrument shows the conditions as they are.

HENRY EMERSON WETHERILL, M. D.
Philadelphia, Penna.

(*Read Wetherill's Hygromedry.*)

GEO. P. PILLING & SON, Sole Licensees, Philadelphia, U. S. A.

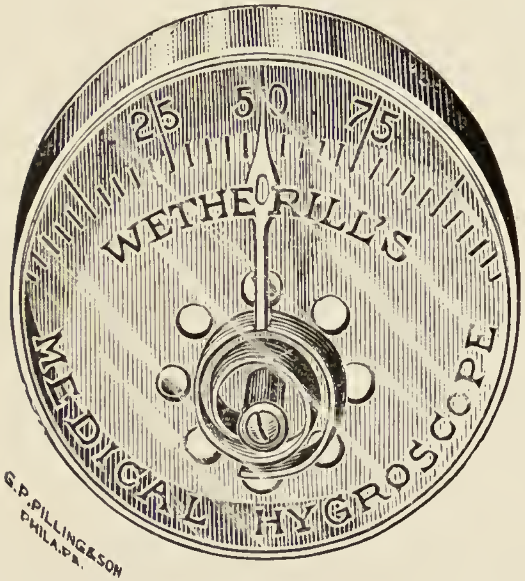
ADVERTISEMENT OF HYGROMED.

The HYGROMED... THE HYGROMED IS A MEDICAL HYGROSCOPE

Designed by HENRY EMERSON WETHERILL, M. D.

What the Clinical Thermometer is to Temperature, the Hygromed is to Moisture.

ACTUAL SIZE



This sensitive little instrument is made of Aluminum, and has a Hygroscopic spiral that acts with the moisture of the air. It is corrected so that it will give the amount of perspiration;—(when it is placed upon the surface for five minutes). When you blow gently into the holes the moisture of the breath is given.

Many useful diagnostic points can be obtained by the use of this instrument in Uremia and in fevers, the dryness of the skin is an important symptom.

In Malaria fever the oncoming of the sweating stage can often be foretold several hours. Many uses suggest themselves,—the effects of diaphoretic drugs and treatments can be measured.

The metabolic relations of the Sweat, Urine, and of the Breath, you can plot, and keep at the same time the moisture of the air, but this latter is not necessary, as after many tests this instrument has been found to have no practical error as caused by meteorological conditions.

For a fuller account of the results obtained with this Medical Hygroscope, see Dr. H. E. Wetherill's articles,—*Journal American Medical Association*,—& *Amer. Medicine*. Vol. 8, No. 4, page 584. Oct. 1, 1904; and Hygromedry, which is a book upon the subject.

The word "HYGROMED" is a trade-mark applied to this instrument. Patents have been allowed. See page 12, Col. 2, of Wetherill's Hygromedry.

23D. AND ARCH STS. PAT. 798,938, SEP. 5, 1905. COMPLETE, WITH CASE, PRICE, $5.00 EACH.

GEORGE P. PILLING & SON, Sole Licensees, PHILADELPHIA, U. S. A.

Many now in use. For Sale by INSTRUMENT DEALERS

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POST-MORTEM BLOOD COLOR SCALE
THE ANTE-MORTEM BLOOD COLORS
THE COLORS OF THE URINE
MOISTURE SCALE
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GEO. P. PILLING & SON, PHILA.

(Copyrighted)

THE H. E. WETHERILL
Hemoglobin Scale
AND
Color Test Book.

For the better determination of Hemoglobin, Moisture, Perspiration, Urine, and the color of the Feces.

A pocket-size book of practical tests.

By Henry Emersom Wetherill, M. D.
PHILADELPHIA, U. S. A.

PRICE, $1.50 NET.

GEORGE P. PILLING & SON, Publishers, Philadelphia.

This book enables the student and busy practitioner to determine with practical accurracy the things tested for at the bedside. The thousands of tests now made with blood colors on paper proves them to be accurate and practical. *See N. Y. Med. Record.* Oct. 21, 1905. *N. Y. Med. Journal.* 10, 21, 1905. p. 881. *Pa. Med. Journal.* Dec. 1905.)

The results have been compared by several competent observers, with the more expensive apparatus that are not so practical, and the results have been accurate. The successful sale of the first Edition has called for a second, with additional useful color test papers, and scales. (Refer to p. 16, and to plate 4.)

WETHERILL'S MEDICAL COLOR TEST SCALES.

THE ANTEMORTEM BLOOD.

The Antemortem Blood Colors are of particular value clinically, and the arrangement of the colors in a circular manner around a perforated center is said by numerous authorities to be of advantage. In addition the colors have been corrected over existing scales, in order that the result may represent the true percentage of standard human Hemoglobin. See L. Napoleon, Boston's Clin. Diagnosis, second edition. P. 524. This scale alone, is worth more than the price of the book. Proven at Panama to be the best, quickest, and most practical scale.

POSTMORTEM BLOOD.

The Postmortem Blood Colors are of advantage in giving a better description of the blood at necropsy and will give a good test of the Hemoglobin, using dried blood.

(Vide Cattell's Postmortem Pathology, 2d edition.)

MOISTURE SCALE.

The Moisture Scale is of practical use in two ways :

First.—It will give very satisfactorily the relative humidity of the sick room. It is a good Hygroscope.

Second.—The test papers enable us to get an exact expression of the amount of moisture thrown off as perspiration or sweat, it is used in measuring excessive sweating.

This is a clinical sympton to which but little attention has been paid, yet the best authorities write of its importance. The scale may be compared with that of the Hygromed. (See Cattel's Post Mortem Pathology, 2d, Edition, page 113.)

URINE SCALE.

This arrangement of Urine Colors facilitates a comparison not heretofore at hand. It is of clinical importance, and gives a numerical expression of the color. (Other colors are to be described.)

FECAL SCALE.

The Fecal Color Scale has been made to cover a need often expressed, for at times it is of the utmost importance to have a record of this matter, and with this scale we can numerically express the condition. The classification table is of aid in etiology, diagnosis, prognosis, and treatment.

Wholesalers, GEORGE P. PILLING & SON, 23d. & Arch St., Philadelphia, Pa.

Can be obtained from most all Medical Supply Houses.

THE TESTOLD

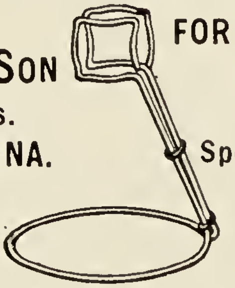
A New Test-tube Holder

THIS TEST-TUBE HOLDER WILL ANSWER HUNDREDS OF USES IN THE LABORATORY AND OTHER PLACES

By Henry Emerson Wetherill, M.D.

OF PHILADELPHIA, PENNA.

Inventor of Torkrit, Hygromed, and Blood Scales



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FOR SALE BY

DEALERS.

Special Prices,

Dr. Wetherill,

Phila.

DESCRIPTION.—The Testold is made of strong spring steel, and has been found to be very handy and useful. It firmly grasps test-tubes, but does not break them, and it will fit all sizes equally well. It is appreciated by Physicians, Chemists, and by general laboratory workers. It is particularly applicable for schools and small laboratories, in the home, or academy. Hot tubes can be set in the stand, using but one hand, and that one holding the tube.

The test-tubes containing boiling chemicals, can be set down at once, without hunting for a rack, for the Holder is its own Rack.

The border of this circular will show some of the many ways in which the TESTOLD may be used. Test-tubes can be held in many positions in drying clean; nothing inside or outside the lip. It does more than other holders, and works better.

**PRICE, 15 Cts. EACH
or Full Dozen, $1.65**

The word "Testold" is a trade-mark applied to this instrument.

THEY SELL ON SIGHT.

DR. H. E. WETHERILL'S NEW CENTRIFUGES.

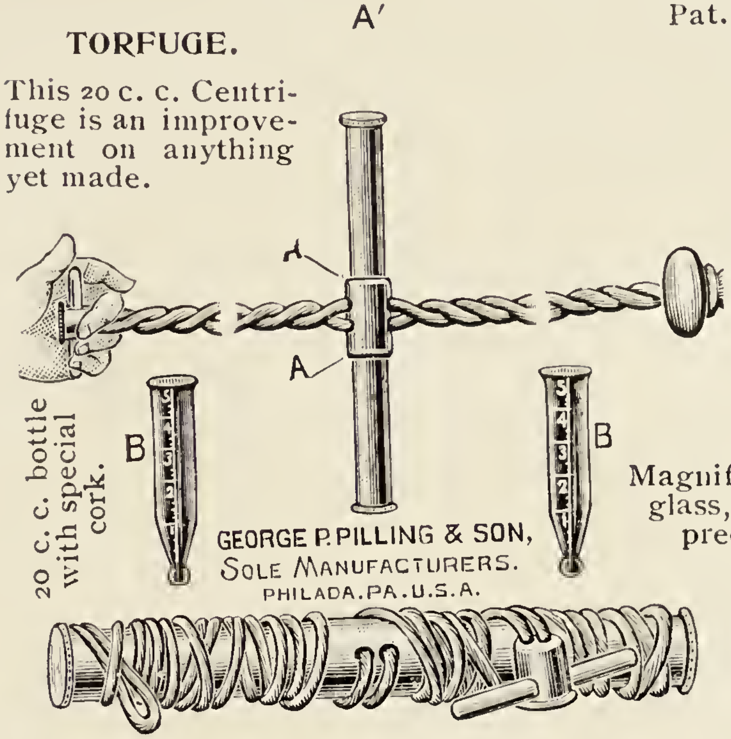
These include the **Torfuge** and the **Torkrit**, also the **Thermometer Setter** and the **Torsion Psychrometer.** (See at page 27, other uses.)

(See Plate No. 5, Side No. 2.)

Pat. Jan. 17, 1905.
780,315

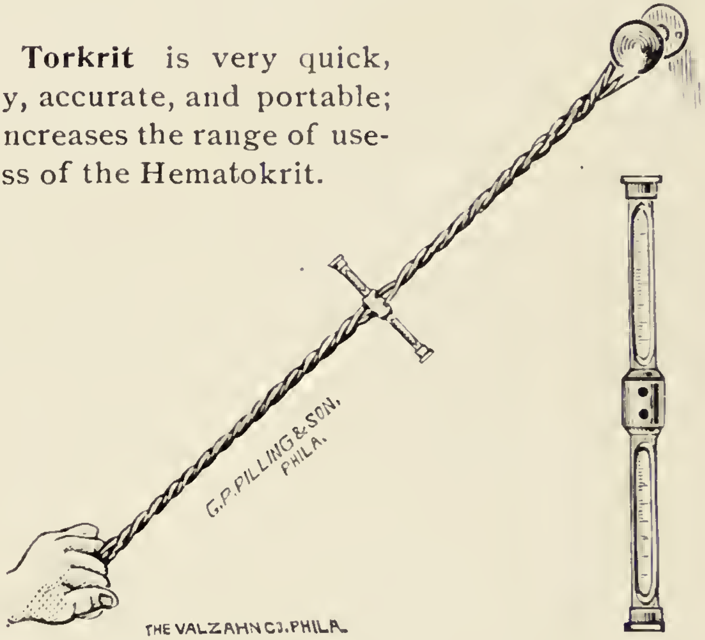
TORFUGE.

This 20 c. c. Centrifuge is an improvement on anything yet made.



Magnifying bulb of glass, for minute precipitates.

This **Torkrit** is very quick, handy, accurate, and portable; and increases the range of usefulness of the Hematokrit.



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Proceedings Phila. Co. Med. Soc., May 10, 1905.

Price, $3.50

A very practical, easy working instrument. Detaches at A and at A′ to insert B. It works well. Graduations on tubes improved, and of new uses.

Price, $2.50.

This Pocket Blood Tester makes the Hematokrit of new utility. Speed 25,000 revolutions per minute. Lately much improved.

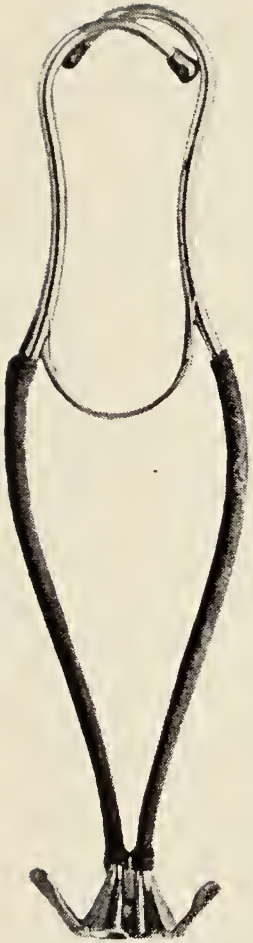
Torfuge and Torkrit are the Trade Mark names.

Sole Manufacturers and Wholesalers, GEO. P. PILLING & SON, 23d. and Arch Sts., Phila.

FOR SALE BY DEALERS.

NOTE.—At Ancon Hospital I got in a 5% Hemoglobin case, 10% corpuscular volume by the Torkrit; and in a case of Black Water Fever I was able to demonstrate the tertian malarial parasites when they were not shown otherwise, and to measure the yellow staining of the plasma.—H. E. W.

USEFUL MEDICAL TOOLS.



Folding Pleximeters Useful in Auscultitory Percussion.

Dr. H. E. WETHERILL'S
Special Double Stethoscope.

For compairing pitch, intensity, quality, time, fremiti, and transmission of sounds. Patent pending. Useful in auscultitory percussion.

It does what other stethoscopes do, and in addition many other things. Price includes a descriptive pamphlet.

See Amer. Jour. Med. Sciences, Vol. 126, No. 5, Nov., 1903. Number 380, page 884.

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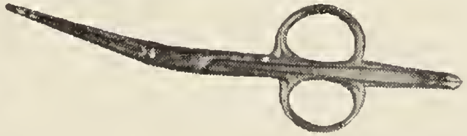
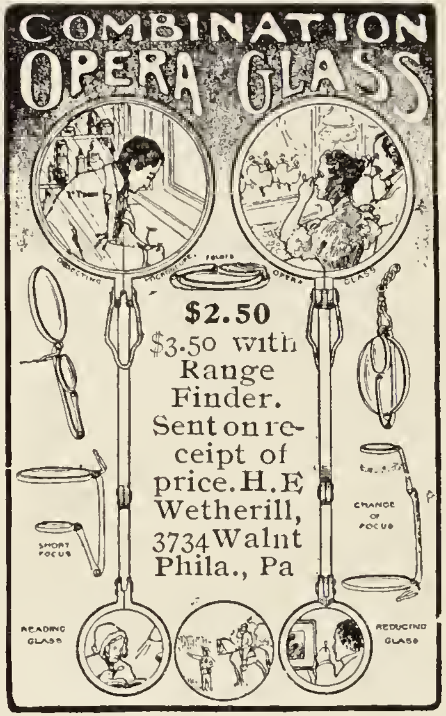
Practically indispensable to any one who has used them. It superceeds the pocket case and the pocket knife, and has been improved upon till now it is a scientific, mechanical, and commercial success. Particularly handy for military, and emergency surgery. The scalpel is detachable with one blade of the scissors, The catch, or cord will hold the forceps together. *See Jour. Amer. Med. Ass'n. Sept. 13, 1902.*



(*Knife Blade Opposite.*) **Price $5.00**



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For Medical use this is a handy magnifier and useful in enlarging the scale of the Hygromed, near-by or at a distance also that of the Clinical Thermometer.

See page 43, Col. 2.

Handy in Opthalmological tests: when supplied with Achromatic Lenses the power is 3 5 diameters; and the field is ample.

A good glass for fine drawing and engraving. (See descriptive circular.) The 1° prism acts as the range-finder.

CASE RECORD.

NAME

ADDRESS Height

Age M. S. Wid. M'l. F. W't. Col. References

Admitted Status Discharged

PREVIOUS HISTORY

PRESENT CONDITION

EXAMINATION

Diagnostic Numerals Stools Blood Urine MOISTURE T.P.R. W't.

Symptoms

Physically

Chemically

By Microscope

Surroundings

DIAGNOSIS

TREATMENTS

Food

Drink

Work

Nursing

REMARKS

RESULT

Location Dr...

Property Matters

....

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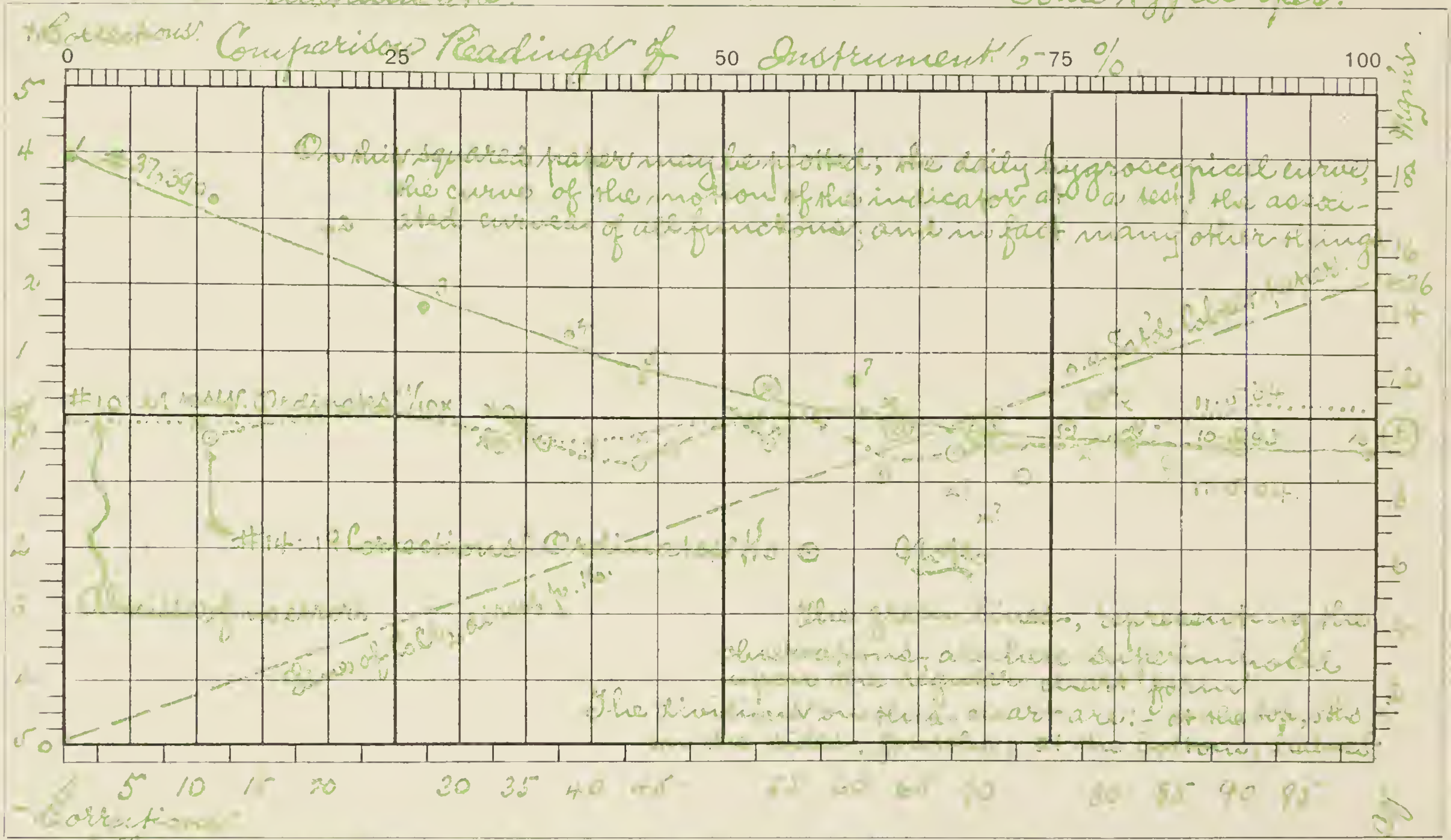
SEE PS. 34 AND 37.

MOISTURE RECORD, and Chart for the Correction~s~ of the Hygromed~s~, and for General Use.

DISEASE. apply corrections to the instruments. PLACE. Phila., Pa USA NAME. Some Hygroscopes.



REFERENCES Illustrating [illegible], on this chart, [illegible] positions; [illegible] of the hygroscopes motions.

P. 12, col. 2.
P. 12, col. 2.
P. 15, col. 2.
P. 29, col. 1.
P. 36 col. 2.
Ps. 34, 57, and 45.

HYGROMED NO. 37, 390. OBSERVER [illegible]
(10.31.'5.) [illegible]

COPYRIGHT, 1905. H. E. WETHERILL. FORM 38,619. PLATE 8, PRICE 1C.

ANNOUNCEMENT.

Dr. H. E. Wetherill's Books on new Physical Diagnostic, and other Instruments.

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A FULLER ACCOUNT of each new diagnostic device is described in detail in a new book soon going to press, and the results of the first tests are given.

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THIS, AMONG OTHER THINGS INCLUDES The Physician's Card Index. Pocket Note Book. The Medical VISCOSIMETER. Pocket Cryoscope. Blood Lancets· The Rotameter and Protractor, with cm. and inch tapes. The Diagnostic Punch. Four special numerical outline figure Charts, and Metal Forms. The references to new clinical, urine, and water tests, and other color scales. Gastric tests, and light tests. The Lacmeter, a practical milk test. The Vaporimeter. The directions for the special double Stethoscope Two other Stethoscopes, using new principles. The Angleometer. The Tafsped The Artificial horizon. Scaled range finder, the Safper, and Crog glasses. New Parallel rule. The Wheeled Centrifuges. The Verniered one corded Torkrit, a 7.5 cm. Hematokrit. For determining corpuscles volumes at altitudes as suggested in Osler's Æquanimitas, p. 115. New Centrifuge, and tables, and numbers useful in medicine, and a generel consideration of medical mensuration.

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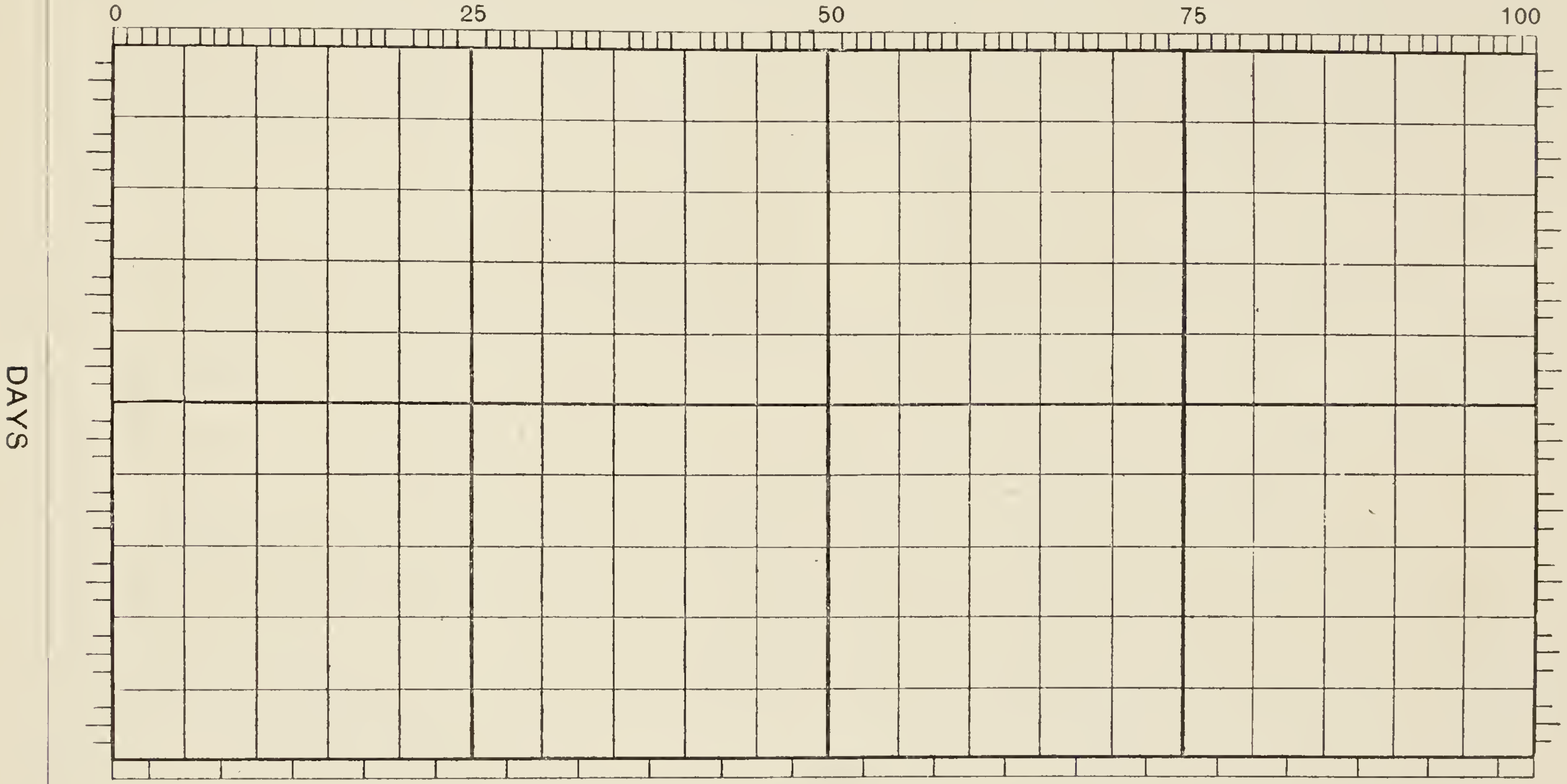
and by BOOK DEALERS.

MOISTURE RECORD, and Chart for the Correction of the Hygromed, and for General Use.

DISEASE. PLACE. NAME.



REFERENCES HYGROMED NO. OBSERVER

P. 12, col. 2.
P. 12, col. 2.
P. 15, col. 2.
P. 29, col. 1.
P. 36 col. 2.
Ps. 34, 57, and 45

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PLATE 8, PRICE 1C.

THE "LACFASEND"
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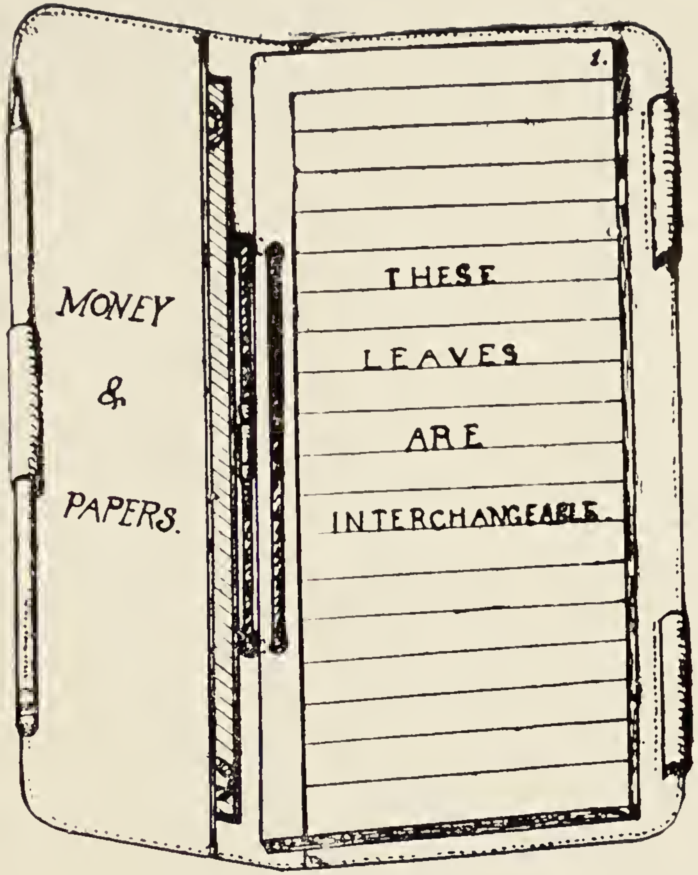
PATENT PENDING



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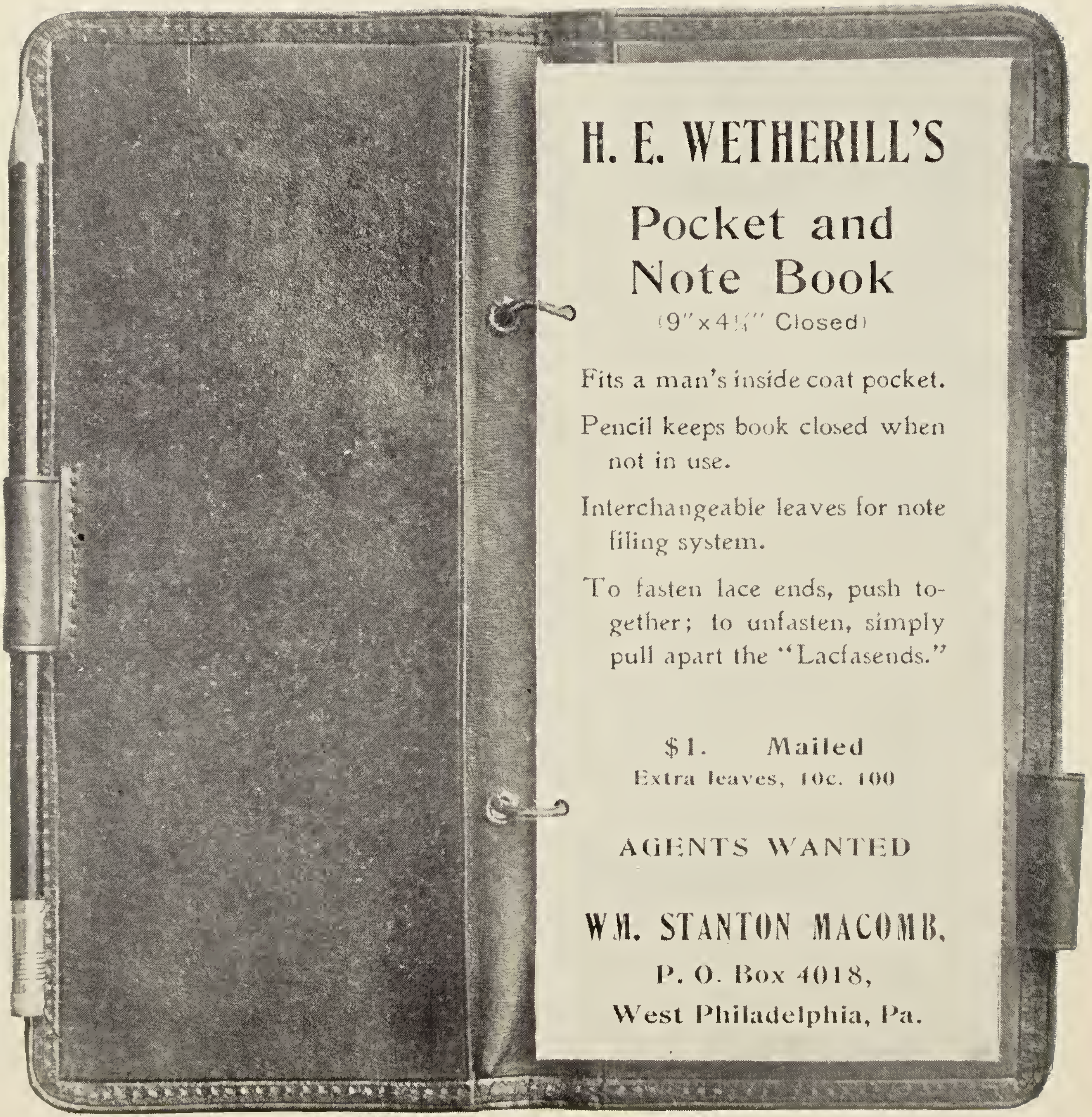

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"No. 798,938.

THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

Whereas, Henry Emerson Wetherill, of Philadelphia, Pennsylvania, has presented to the Commissioner of Patents a petition praying for the grant of Letters Patent for an alleged new and useful improvement in

HYGROSCOPES,

a description of which invention is contained in the specification of which a copy is hereunto annexed and made a part hereof, and has complied with the various requirements of Law in such cases made and provided, and

Whereas, Upon due examination made the said Claimant is adjudged to be justly entitled to a patent under the Law.

Now therefore, these Letters Patent are to grant unto the said Henry Emerson Wetherill, his heirs or assigns for the term of SEVENTEEN years from the fifth day of September, one thousand nine hundred and five, the exclusive right to make, use and vend the said invention throughout the United States and the Territories thereof.

In testimony whereof I have hereunto set my hand and caused the seal of the Patent Office to be affixed at the City of Washington this fifth day of September, in the year of our Lord, one thousand nine hundred and five, and of the Independence of the United States of America the one hundred and thirtieth.

E. B. MOORE,
Acting Commissioner of Patents.

UNITED STATES PATENT OFFICE.

HENRY EMERSON WETHERILL, of Philadelphia, Pennsylvania.

HYGROSCOPE.

No. 798,938. Specification of Letters Patent. Patented Sept. 5, 1905.

Application filed July 18, 1904. Serial No. 217,021.

To all whom it may concern:

Be it known that I, Henry Emerson Wetherill, a citizen of the United States, residing in the city of Philadelphia, State of Pennsylvania, have invented certain new and useful Improvements in Hygroscopes, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to hygroscopes, and has for its object to provide a reliable instrument of that class which while capable of use in general meterological work is adapted especially for measuring the perspiration in pathologic diagnosis. Heretofore no such instrument has been at the service of the medical profession except one or two, which are expensive to construct, easily broken or operatively disrupted, and not capable of accurate adjustment nor adapted to use under many conditions which commonly prevail in the laboratory, especially in pathologic diagnosis.

My invention has for its object to provide an instrument of this class not open to these objections which shall be durable, simple, compact, cheap in construction, readily adjustable, perfectly air-tight under proper application, and reliable in its measurements of moisture.

To these ends it consists of the device hereinafter described, the novel features in which will be pointed out in the several clauses of claim.

* In the drawings illustrating my invention, Figure 1 is a plan view of the dial-plate, showing no other part of the instrument except the end of the spring-post which projects through the dial and the washer, to which said end is riveted. Fig. 2 is a bottom plan view of the device with the perforated bottom plate removed. Fig. 3 is a vertical section on line 1 2 of Fig. 2 looking to the left. Fig. 4 is a plan view of the perforated bottom plate. Fig. 5 is a side elevation intended to illustrate the construction and arrangement of certain elemental features, and Fig. 6 is a side elevation of the indicator.

The shell or casing A is of stiff metal and light in weight, and for these purposes I make it of aluminium, and this metal is desirable, as it avoids condensation of moisture, which would affect the degrees of humidity measured. Its vertical wall a is preferably annular in shape, and at each head end it is provided with an internal shoulder b b, slightly beveled, the function thereof being to removably hold the correspondingly-shaped annular edge of the dial-plate and of the perforated bottom plate, both hereinafter described.

The dial-plate contains upon its top or outer surface the numerous "25, 50, 75," or others, indicating relative humidity percentages of moisture, and on its under or inner surface the dial-plate contains the index-line c. (Shown in Fig. 1 in dotted lines.) For purposes of lightness and durability and to lessen the amount of moisture deposit on the dial I have substituted for glass a thin and transparent celluloid as the material for the dial-plate as being preferable. Mica, glass, gelatin, or other transparent or translucent material can be used, but with less advantage.

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* See page 15.

The indicator-finger d (shown in detached elevation in Fig. 6) must necessarily be of the lightest possible weight, and for this reason, while preserving stiffness, I make it of aluminum. It consists of a thin rod bent downward at its inner end to form the side d', then upward to form the side d2, the purpose being to form a loop d3. A third bend d4 is preferably added to better preserve the stiffness of the loop-walls. An arrow or perforated point may be used, the width of the point being one-fifth the distance between the smallest graduations of the scale.

The sensitive spring h is made spiral in form. It is a thin copper band covered on the outer side with a thin membrane fastened to the surface of the metal by cement, such as rubber-cement. The copper may be plated or dipped in a lacquer to protect it from corrosion. I have discovered by a series of experiments that the skin of an egg—namely, the membrane next to the shell and that surrounds the albumen—is exceedingly desirable for that purpose, though paper, gelatin, the known photo-negative films, or human hair freed from fat may be substituted, but with less advantage. The membrane or its said substitutes in order to make it more highly sensitive to moisture must be treated with a chemical solution. As a preservative of it, but chiefly to make it contract under the slightest moisture, I prepare the membrane by submitting it to a coating of chlorid of cobalt, for which purpose a four-tenth saturated aqueous solution is best, as found by extensive testing. Herein lies a basic principle of my invention—namely, in the provision of a hygroscopic membrane chemically treated with a hygroscopic salt; but the mounting of such a membrane upon a metallic band carrying the indicator-point is equally fundamental, and so, also, is the provision of such a band in the form of a spiral or so that the change of size of the membrane will cause the copper spring to move radially.

The metallic support for the chemically-treated membrane is preferably made for a medical hygroscope of a thin spring copper band two-thousandths of an inch in thickness and three-sixteenths of an inch in width, though silver metal would answer or gold alloy. The band is to be spiraled. Each end is preferably given a short bend to bind the membrane thereon, and is preferably pointed or narrowed at the inner end for easy insertion in the supporting-post hereinafter described. It is spiraled enough to give two and one-half turns or rounds when the indicator shows seventy-five per cent. of humidity and is so spiraled and arranged in the post that the final or outward turn or bend of the metal band will impart a circular plane of movement to the indicator carried thereby, centering on the supporting-post as its axis in order that it shall always rotate in a true circular path. The first turn of the spiral must also be a circular curve.

The indicator is mounted on the spiral metal band by slipping its loop over the outward end of the metal band, and obviously this construction and arrangement of the parts will provide for the general adjustability of the indicator on its spiral metallic carrier, a new and important factor of great value. The indicator clamps firmly in its place on its carrier without the use of cement, which is a decided improvement.

The supporting-post m is substantially a cylinder of metal with reduced shouldered ends at either or both extremities. The upper end is supplied with a lower washer n, and its projecting end above the washer passes through an aperture in the dial-plate, and another washer n' is placed thereon above the dial-plate, the top being then riveted on the upper washed. The extreme top end of the post is slotted, as at n2, Fig. 1, so that the post, indicator, and its spiral carrier can be moved rotatably as a whole for the purpose of final adjustment. The body portion of the post is slotted longitudinally as at t, as it is within this slot that the inner end of the spiral metal band is inserted and thereby mounted; but the slot is made slightly longer than the width of the band in order that it may be adjusted vertically on the post.

* The instrument can be and frequently is with advantage used with an open base; but I prefer to provide a basal covering in the form of the annular plate T. (Shown in Fig. 4.) This plate is of light aluminum metal, with an edge adapted to fit the inner shoulder on the edge of the casing or shell. It is perforated in several places, as at p, in the region of the spiral spring to admit cutaneous moisture in the form of vapor from the body when placed upon a patient. The basal plate will prevent hairs from stopping the motion of the spiral carrier.

The smaller perforation s is provided to admit the passage therein of the lower end of the post, thereby not only holding the parts together, but bringing the apertures p immediately below the sensitive spiral band carrying the indicator. To remove the closing-cap and opening the casing, it is merely necessary to lightly press the head of the supporting-post.

The operation of the device is obvious from the description given, and it is sufficient to note that the fundamental principle in the mode of operation of the indicator-carrier is the spiral form of the sensitive-carrier, which being covered with a chemically-sensitized membrane contracting under the effect of moisture or expanding under the loss of such moisture absorbed causes the balanced indicator to rotate radially. The changes of color which take place in the chemically-treated membrane may be used to standardize the instrument in comparison with a chlorid-of-cobalt color-scale.

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* See page 15.

Some of the decided advantages of my device from a mechanical standpoint are that It is simple in construction, of few parts, and most of its elements replaceable without affecting the others. From a medical point of view it is easily cleaned, can be made antiseptic, its form and character are such that it can be applied to the skin or in other ways to a patient, so as to exclude all atmospheric humity, and after use its perforated plate can be removed and the casing inverted, so that the moisture inside the instrument will pass off and the elements restored to mark the normal humidity of the outside atmosphere. The markings of the indicator in clinical diagnosis can be plotted on charts similar to those used in the wards of hospitals, and as the determination of the amount of perspiration in different conditions is of considerable diagnostic, therapeutic, and prognostic value it is important to have an instrument that will mathematically express the condition, and thus aid in symptomatology and secondarily in treatment. With my instrument properly applied, as aforesaid, to the skin of a patient the indicator will in a few mniutes enable a correct reading of the percentage of moisture to be made.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. In a hygroscope, a hollow supporting-frame, a transparent dial-plate thereon, a post mounted in said dial-plate and extending within the frame, a spiral metallic band lined on one side with a contractible material which has been made sensitive to moisture, said

spiral band being arranged edgewise within the frame and mounted by one end in said post, and an indicator carried on the free end of said band, operating to move radially on the surface of the dial-plate.

2. In a hygroscope, the combination with a suitable containing-casing provided with a graduated dial-plate, of a post supported within the casing, an indicator-carrier mounted edgewise and by one of its ends in said post, said carrier consisting of a flat spiral band having a plurality of true circular curves whereby its free end may rotate in the arc of a true circle, said carrier-band being made sensitive to moisture, and an indicator-finger mounted on the free end of the spiral carrier.

3. In a hygroscope comprising a hollow containing-casing, cylindrical in shape, a transparent dial-plate closing one end thereof, an indicator-carrier post, means to support one end of said post rotably in said dial-plate, a spiral band of metal, a covering on said band, which is made sensitive to moisture, an indicator-finger mounted on the free end of said band, and a removable plate forming the bottom of the casing and provided with an opening to receive the lower end of the post when the instrument is closed.

4. In a hygroscope, an indicator-carrier consisting of a spiraled band, means supporting it at one end, in such manner that its free end will move radially under a longitudinally-exerted force, and a lining cemeted to one side thereof, said lining consisting of the skin of an egg which has been coated with chlorid of cobalt.

5. In a hygroscope, a containing-casing, a transparent dial-plate thereon, a longitudinally-slotted post supported within the casing, a spiral indicator-carrier covered with a sensitive membrane, and having one of its ends mounted vertically adjustable in the slotted post, and an indicator carried on the free end of the spiral carrier.

6. In a hygroscope, the combination with a suitable casing and a sensitized spiral indicator-carrier mounted therein, of an indicator the rear end of which is provided with a loop whereby it may be supported adjustably on the indicator-carrier.

7. In a hygroscope, a longitudinally-slotted post, a spiral band, made contractible under moisture and having its inner end mounted vertically adjustable in said post, and an indicator-finger having a looped end mounted longitudinally adjustable on the free end of the spiral band.

8. In a hygroscope, a containing-casing, a transparent dial-plate thereon, a post maintained by one end in the dial-plate, a removable perforated base-plate for the casing, an opening in said plate to receive the lower end of the post, and a sensitized spiral indicator-carrier mounted by one end in said post.

9. In a hygroscope, a hollow casing interiorly shouldered at one end, a perforated plate adapted to be removably held in the shouldered end of the casing, a transparent dial supported in the opposite end of the casing, a post supported within said casing, a spiral band lined with a contracible material made sensitive to moisture and mounted edgewise by one end in said post; and an indicator-finger mounted on the free end of said spiral band.

In testimony whereof I have hereunto affixed my signature this 12th day of July, A. D. 1904.

HENRY EMERSON WETHERILL.

Witnesses:
HENRY T. GULLMANN,
H. I. FENTON."

"Wetherill's New Physical Diagnosis
AND
Surgical Instruments.

(No. 2372.)

The Franklin Institute acting through its Committee on Science and the Arts, investigating the merits of "THE NEW PHYSICAL DIAGNOSTIC AND SURGICAL INSTRUMENTS," invented by Dr. Henry Emerson Wetherill, of Philadelphia, Pa., reports as follows:

These instruments are covered by Letters Patent No. 780,315 dated January 17, 1905, and No. 798,938 date (Sep. 5, 1905. H. E. W.)

These instruments consist of The Hygromed, or Medical Hygroscope, which is an instrument to detect the amount of moisture in the skin and is to moisture what the clinical Thermometer is to temperature. This instrument is especially useful in uraemia in detecting the approach of convulsions denoted by a gradual loss of moisture in the skin. It is also useful in malarial and other fevers in showing by an increase of moisture in the skin, the approach of the critical sweat.

The second instrument is the Haematokrit. This invention relates to instruments used in pathologic diagnosis and other clinical work for the separation and precipitation in a graduated test tube or other like containing vessel of the contained solids in the liquid treated. These devices are known by the generic name of the Haematokrit when applied to the separation and precipitation of blood corpuscles and by the specific name of Centrifuge when applied to the separation of solids in urine, human and other milk, chemical precipitates, Pharmaceutical preparations, etc.—all such instruments operate on the principle of quick separation of solids from liquids by rapid centrifugal action given to the test tube containing the liquid acted on. All the complicated and expensive mechanical means heretofore employed, rotate the tube in a horizontal plane only and in one direction. This device enables the tube to be rotated in any plane and in both directions. This device has the merit of being very small and portable, so that it can be used at the patients' bedside and the tests made rapidly at the regular visit of the physician. Another point in its favor is that it is sold at a moderate price (less han half the price of the complicated machines); and this will be a boon to the younger members of the profession, as it will place in their hands a very useful instrument at a price within their reach.

The third diagnostic instrument is an improved form of Stethoscope, or as the inventor calls it a "Double and Differential Stethoscope," as owing to its peculiar arrangement, that of having two sound bells instead of one, the sounds in both lungs or in different parts of the same lung can be differentiated at the same time. By an ingenious arrangement in the shape of a projection from the bells, percussion may be practiced at the same time as auscultation or separately or in two different places at the same time.

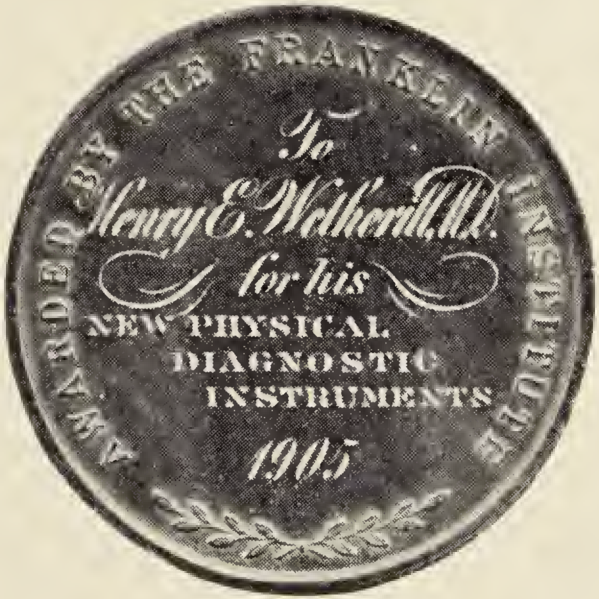
An ingenious pair of scissors was also exhibited to your Committee, combining in one instrument seven different instruments such as are usually found in the ordinary pocket case, namely—scissors, eyed-probe, knife, forceps, needle holder, grooved director and elevator for depressed bone. The mechanical work on all these instruments is first class and they combine efficiency with general excellence.

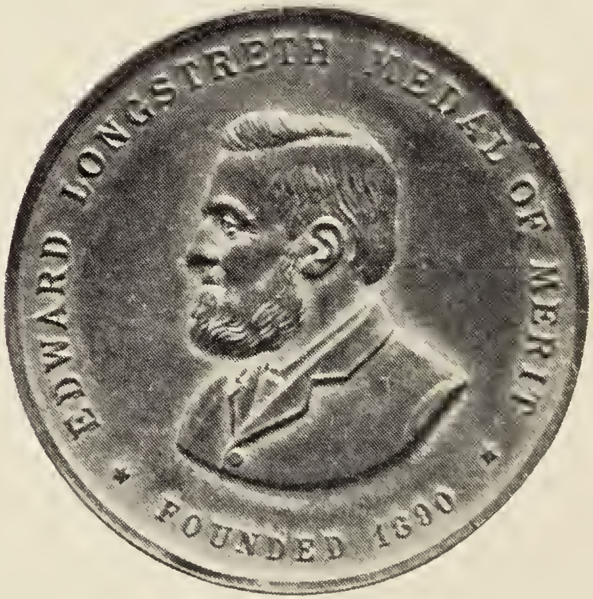
The Committee therefore recommends the award of the Edward Longstreth Medal of Merit to the inventor, FOR his “NEW PHYSICAL DIAGNOSTIC AND SURGICAL INSTRUMENTS.”

Adopted at the stated meeting of the Committee on Science and the Arts, held Wednesday, December 6, 1905.

JOHN BIRKINBINE,
President.
WM. H. WAHL,
Secretary.

Countersigned DR. E. GOLDSMITH,
Chairman of Committee on Science and Arts.”





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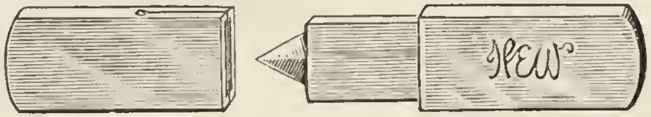

This handsome little instrument for hemotologists has the advantages—that it gives a constant prick, as in determining blood volume of the body using the Torkrit's Tube.

With skill the amount of cut may be regulated.

It will not roll when laid to one side, and the point is made with a sheath that prevents rusting, or infection of the blade.

The patient is not annoyed by the sight of a knife, and the physician does not have to stop to regulate the depth for the cut.

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This instrument was envolved from actual practical requirements, and does the work better than any others that have been tried. It is flat and compact and goes handily in the pocket of the new Hemoglobin Scale, by Wetherill. The depth of the cut is stamped upon them—together with its width.

They may be had of various sizes.

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Called the "Lacfasend"

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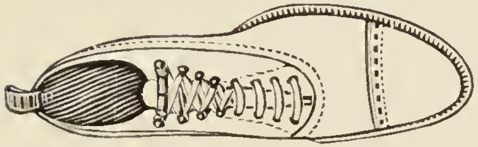
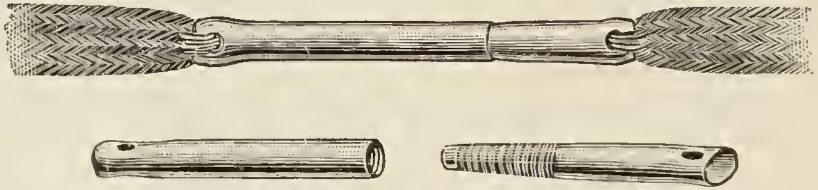




This lace is shortened or lengthened by the methods of applying it to the shoe. They may be sewn on, or supplied for any lengths.

When a lacing breaks from wear the ends may be screwed together and the broken parts tied in the usual way.

The "Tags" don't pull off

They screw tightly together, and the shoe is laced as though there was an endless cord.

The shoe is laced tightly, the fastening is secure, and don't undo till you grasp the bar, and by one pull detach the lacing.

This fastening is useful for many purposes

You no longer run in danger of your laces untying, and stepping upon them—trip or injure the string.

They are dressy, very neat and compact, and there are no more hard knots to untie at nights.

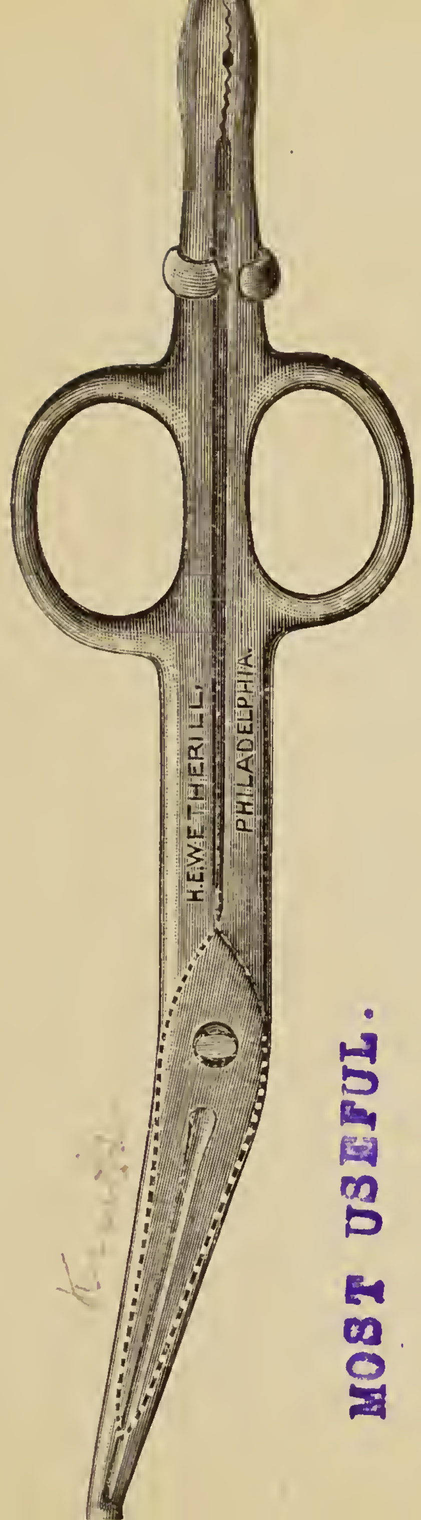
The screw once fastened, the laces are easily applied in the morning, being looped over the hooks or threaded through the holes in the ordinary way. In the latter case the lace ends are twisted backwards and then forwards into position.

These laces are time and trouble savers.

PRICE OF 2 COMPLETE, 10 CENTS.

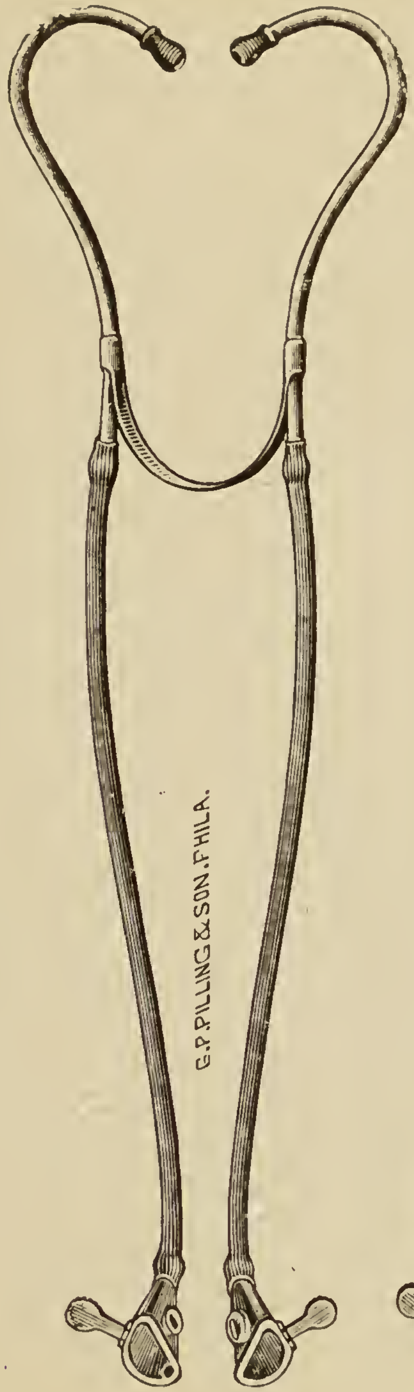
HENRY EMERSON WETHERILL,
3734 WALNUT STREET, PHILA., PA.

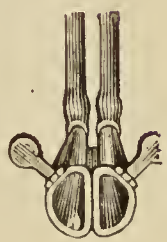
LATEST FORMS OF—



MOST USEFUL.

MEDICAL SCISSORS





DOUBLE STETHOSCOPE

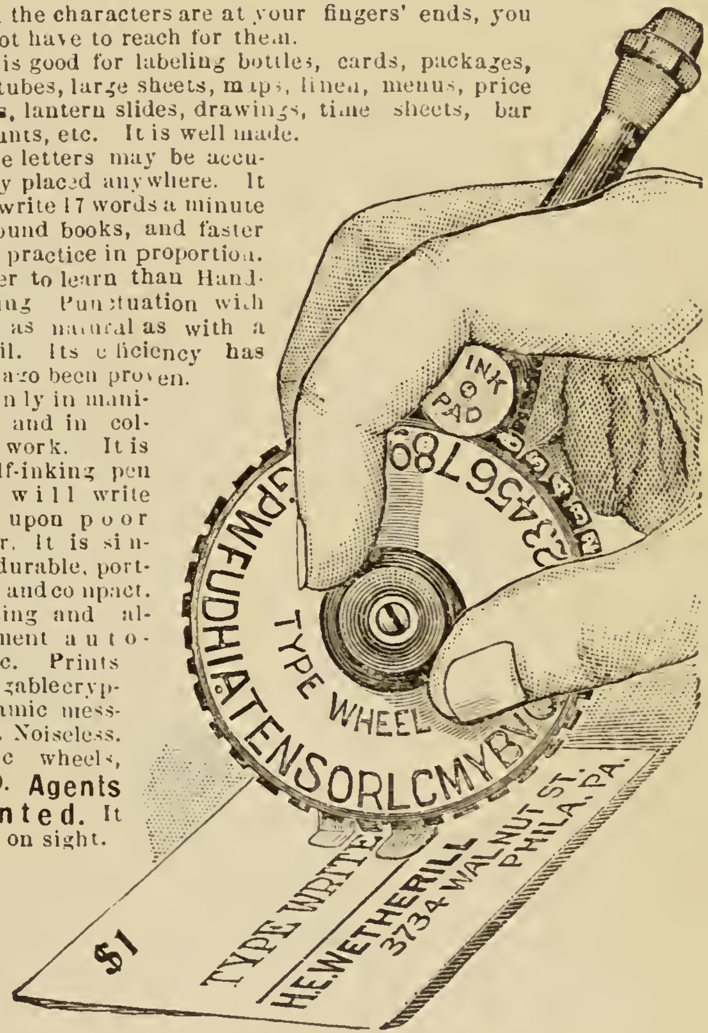
The "TYPWEL" is a useful printer, for many purposes.

All the characters are at your fingers' ends, you do not have to reach for them.

It is good for labeling bottles, cards, packages, test tubes, large sheets, maps, linen, menus, price cards, lantern slides, drawings, time sheets, bar accounts, etc. It is well made.

The letters may be accurately placed anywhere. It will write 17 words a minute in bound books, and faster with practice in proportion. Easier to learn than Handwriting. Punctuation with it is as natural as with a pencil. Its efficiency has long ago been proven.

Handy in manifold, and in column work. It is a self-inking pen that will write well upon poor paper. It is simple, durable, portable, and compact. Spacing and alignment automatic. Prints changeable cryptogramic messages. Noiseless. Music wheels, $1.50. **Agents wanted.** It sells on sight.



DR. HENRY EMERSON WETHERILL,
3734 Walnut St., - Philadelphia, Pa.

CORRECTIONS

Page 10, 1st Col., 15th line. The word "There" not needed.
Page 11. Copyright 1906, not 1905.
Page 36, note, 3d line. "the" not he.
Page 51, 2d col., 9th line. Scleroderma, not scleroder, ma.
Page 55, 1st col. I, not one.
Page 62, 2d col. 3.5 diameters, not 3 5.
Page 65, bottom line. A, in general, should be inverted.
Page 68. References could have been omitted, see page 64.
Page 69. $1.00, not $1.25.